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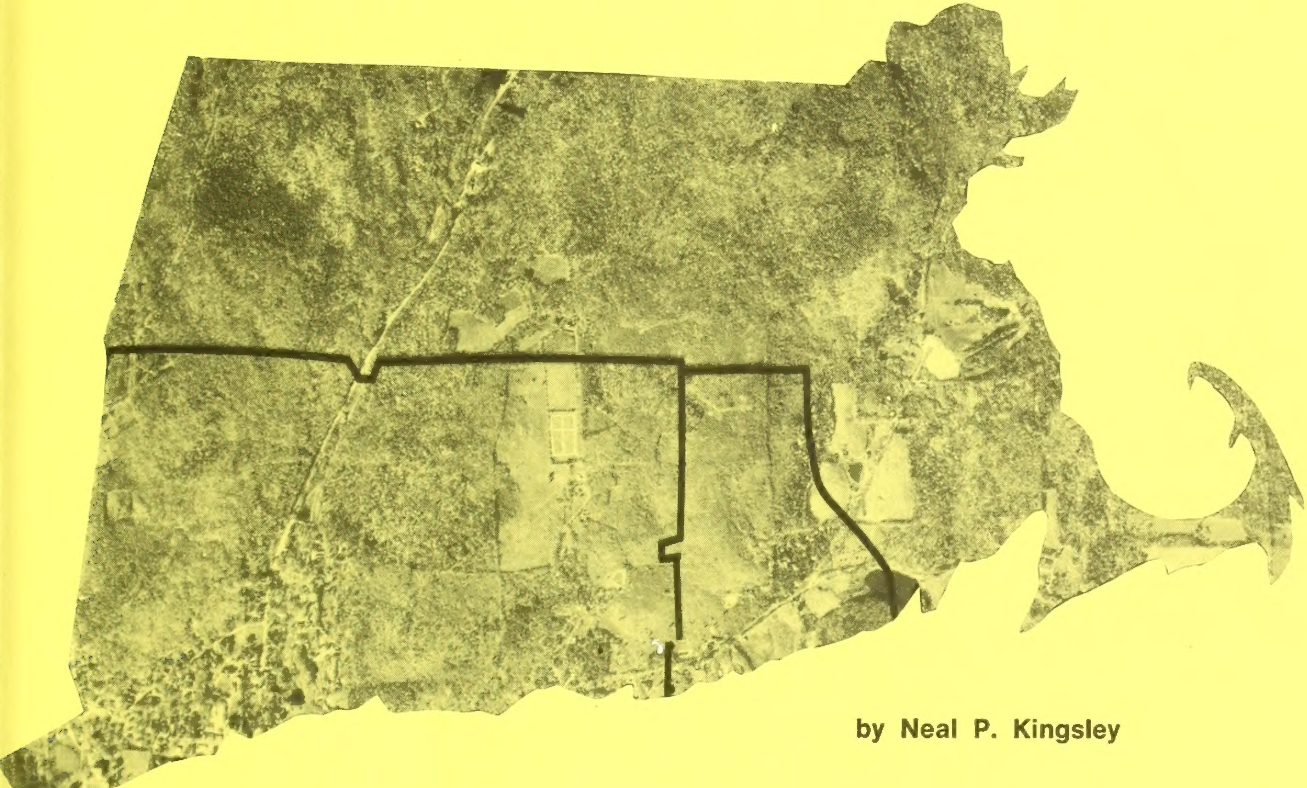
THE FOREST-LAND OWNERS OF SOUTHERN NEW ENGLAND



by Neal P. Kingsley

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NORTHEASTERN FOREST EXPERIMENT STATION
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COVER PHOTO—An aerial view northeast of Ashburnham, Massachusetts.

THE AUTHOR

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ABSTRACT

A statistical-analytical report of a mail canvass of the owners of privately owned commercial forest land in the three Southern New England States—Connecticut, Massachusetts, and Rhode Island. The study was conducted in conjunction with the second forest survey of Southern New England by the USDA Forest Service. Trends in forest-land ownership and the attitudes and intentions of owners regarding reasons for owning forest land, timber management, timber harvesting, recreational use, etc., are discussed.

THE
FOREST-LAND OWNERS OF SOUTHERN NEW ENGLAND

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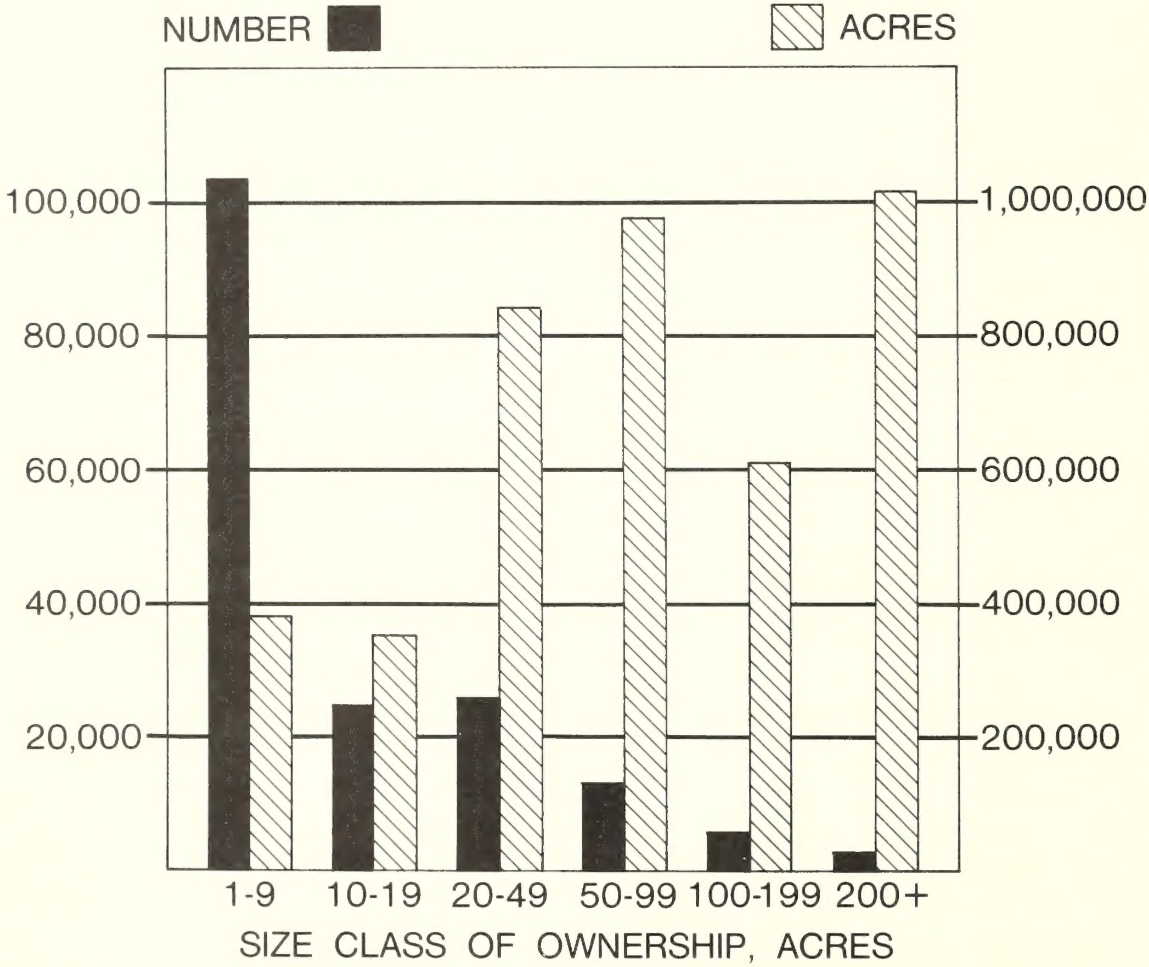
Figure 1.—Estimated number of forest-land owners and acreage owned.



THE FOREST-LAND OWNERS OF SOUTHERN NEW ENGLAND

THE RECENTLY COMPLETED forest survey of Southern New England provided estimates of forest area and timber volume by broad owner categories *(Kingsley 1975)*. But it did not provide estimates of the volume or acreage of timber that might be available for harvesting. Nor did it describe the attitudes of typical forest-land owners, their reasons for owning forest land, or their views toward timber harvesting, forest management, and recreational use of the land by the public. The purpose of this report is to provide this information in a form that will be useful when used in conjunction with the forest-resource report for the State.

Many studies have been undertaken by various institutions and agencies to determine the attitudes and objectives of forest-land owners. Most of these studies have been limited to individual counties or groups of counties. Though such studies provide a wealth of detailed information for these areas, they do not cover a broad geographical region; nor are they designed to be used in conjunction with current forest-resource data. Nonetheless, they stand as excellent sources of supplementary data about the forest-land owner. Four such studies have been conducted in Southern New England *(Babeau et al 1965, Marrama 1972, New England Research Inc. 1974, Zumwalt 1953)*. The author recommends these publications to the serious student of forest-land ownership problems in the Southern New England Region.

To fully understand the data and conclusions presented in this report, the user of these data is advised to read the discussion of study methods and sampling errors presented in the appendixes at the end of this report.

184 Thousand Owners

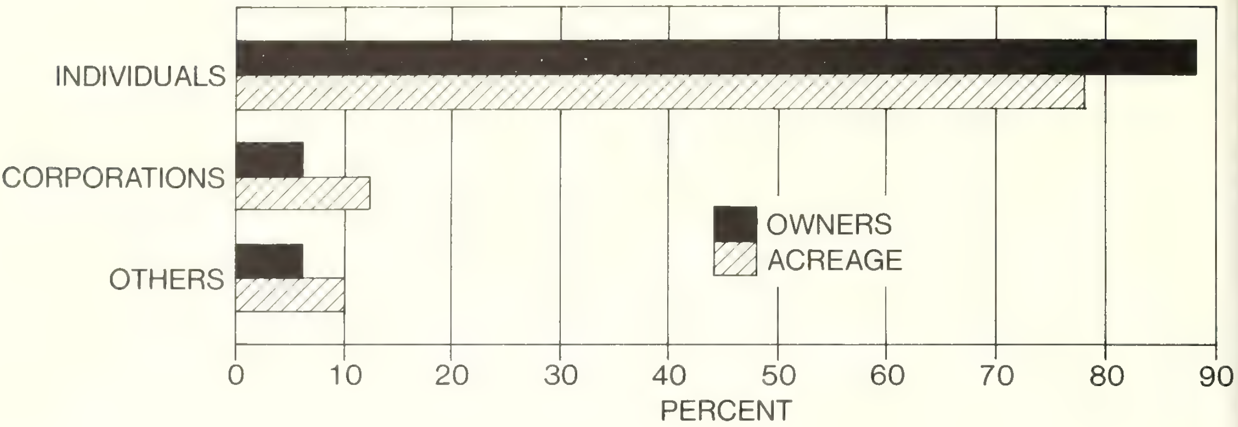
There are an estimated 184,100 owners of private commercial forest land in the three Southern New England States—Connecticut, Massachusetts, and Rhode Island. The area of forest land these owners own ranges from 1 acre to more than 20,000 acres. The average ownership is 24.2 acres. However, 58 percent of the ownerships fall in the 1-to-9-acre class. And less than 1 percent are of more than 500 acres (fig. 1).

88 Percent are Individuals

Individuals—as opposed to corporations, partnerships, and other forms of ownership such as associations, trusts, or individual estates—account for 88 percent of all ownerships. Individuals hold nearly 3.5 million acres —78 percent—of the region's privately owned commercial forest land.

The occupations of these individual owners cover a wide spectrum. Retired persons own 22 percent of the commercial forest land. Executives and professionals own 17 and 16 percent respectively. In 1953 farmers owned about 24 percent of the region's commercial forest land. In 1973 farmers accounted for only 4 percent of the individual owners and held only 10 percent of the land owned by individuals. This drop is vivid evidence that the farmer's place in rural Southern New England has declined substantially in recent decades.

Figure 2.—Percentage of owners and acreage owned, by form of ownership.



Corporations of one kind or another own more than 522 thousand acres—12 percent—of the forested land in Southern New England. Corporations engaged in forest-based industries, such as sawmilling, account for only 5 percent of this land, or 25,600 acres. Corporations engaged in real estate account for 24 percent of the forest land held by corporations, and incorporated farms account for another 12 percent. Other industries and other corporations account for the remaining 59 percent (fig. 2).

Southern New England forest-land owners are typically older, well-educated, high-income people. Owners 50 years old and older own 67 percent of the land held by individuals. The 36 percent of the individual owners who have more than 12 years of formal education own 43 percent of the land held by individuals. Owners with incomes in excess of $10,000 per year own a total of more than 2.1 million acres—61 percent—of the commercial forest land owned by individuals. Nearly half of the individuals who own forest land in Southern New England spent the first 12 years of their lives in an urban environment.

Most owners have owned their forest land for 10 years or more. These owners hold 65 percent of the private commercial forest land in the region.

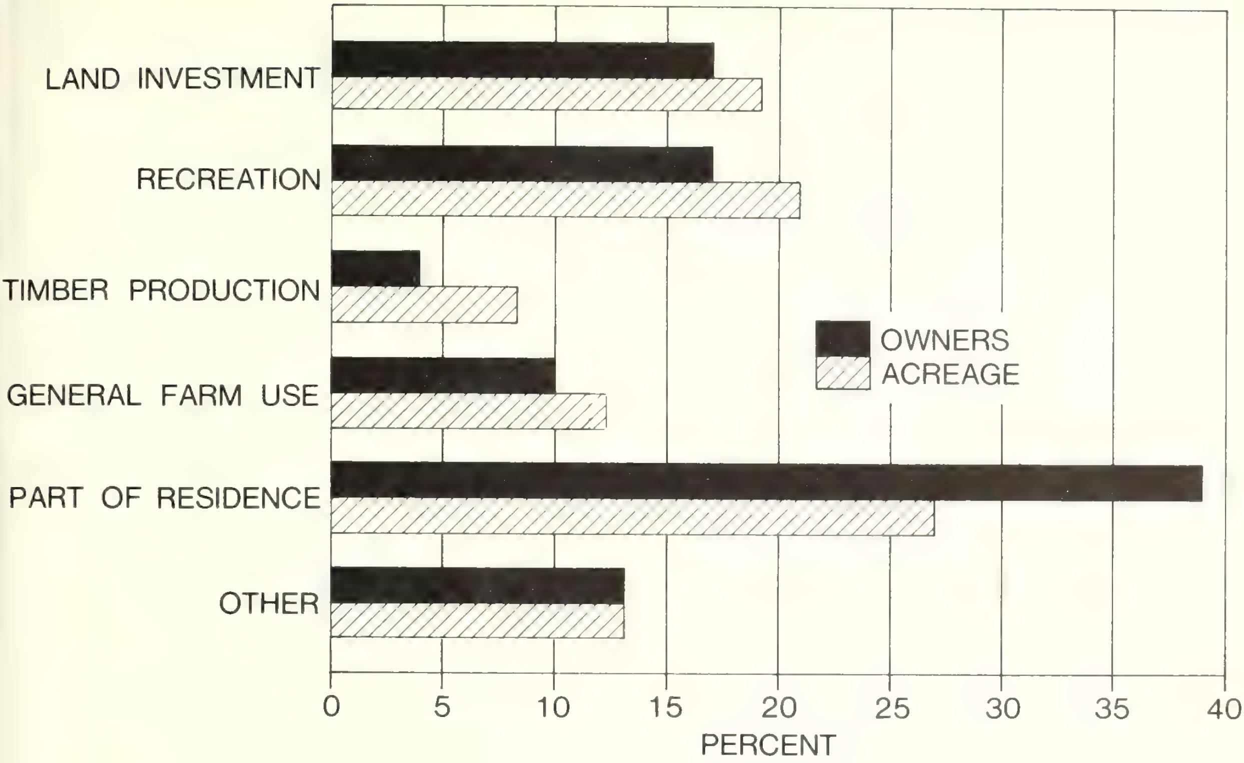
Many observers have wondered at the importance of the non-resident or absentee landowners. The results of our research show that only 5 percent of the forest-land owners in the region reside more than 15 miles from their land. However, these owners typically hold larger-than-average tracts, and they own 11 percent of the privately owned commercial forest land in the three States. Eighty-seven percent of the region's forest-land owners live either on their land or within 5 miles of it.

Why People Own Forest Land

More than one-third of the forest-land owners in the region—39 percent—own forest land simply because it is part of their residence. However, these people, on average, own smaller tracts of land. Land investment and recreation each were listed by 17 percent of the owners as the most important reason for owning forest land. The recreationists, however, control 21 percent of the land, while the land investors own 19 percent. Owners who hold forest land for timber production account for 4 percent of the owners and own only 8 percent of the privately owned commercial forest land in the three-state region (fig. 3).

To gain a further insight into why people own forest land, we asked owners what benefits they had derived from their land in the past 5 years and what benefits they expect to derive in the coming 5-year period. Forty-six percent of the owners indicated esthetics as the most important past benefit, and 39 percent expect it to be the most important future benefit. The second major benefit, both past and future, was the increase in land value. Recreation ran a close third. Only 2 percent of the owners, who hold only 5 percent of the commercial forest land, indicated that sale of timber was

Figure 3.—Reasons for owning forest land, by percentage of owners and acreage.



the major benefit in the past 5 years. And only 4 percent of the owners thought it would be the most important benefit in the coming 5 years. Clearly, Southern New England forest-land owners do not look to their forest land as a source of income from timber production, but as a source of such intangible benefits as esthetic enjoyment and recreation.

PROSPECTIVE TIMBER AVAILABLE FROM PRIVATE OWNERSHIPS

One of the major objectives of this study is to provide an estimate of the volume of timber that is available for harvesting in the region. Because the answer to this question is influenced by many social and economic factors, it is difficult to determine exactly how much timber is available at any one time. Furthermore, even if such an estimate were made, its utility would be limited to the time to which it applies, because industrial developments, market conditions, and social and economic developments can drastically alter those factors that interact to determine how much timber could be brought to market. We can, however, get an idea of how much timber might be available in Southern New England by examining both the past practices and future intentions of the region's forest-land owners.

To answer the question of how much timber is available for harvesting, we must first estimate what portion of the privately owned commercial forest land in Southern New England constitutes a land base that can be considered as producing timber that will become available. To do this, it is necessary to analyze the answers given by owners to certain questions. The owners of 1,865,500 acres said that they have not harvested timber in the past for reasons that would seem to preclude the possibility of future harvests on that land during the present owner's tenure. These reasons are:

1. Logging would destroy the scenery.
2. The owner distrusts loggers.
3. The owner feels that he has an insufficient area to permit harvesting.
4. The owner is opposed philosophically to the harvesting of timber.
5. The owner feels that harvesting would destroy the value of the land for hunting or wildlife.
6. The owner is in the process of selling the land.
7. The land is tied up in an estate settlement.
8. Logging, in the owner's opinion, would constitute a fire hazard.

Subtracting the acreage these people own from the 4,454,500 acres of privately owned commercial forest land in Southern New England leaves 2,589,000 acres. Of this, 207,200 acres are owned by owners who have harvested timber in the past but say that they do not plan to harvest again. This gives rise to the question: How much of the land owned by these past harvesters should be withdrawn from the timber-producing base?

About half the acreage held by owners who have not harvested timber is held by those who have not for some reason that would preclude future harvesting. It seems reasonable to conclude that the same is true of those owners who have harvested timber in the past, but do not plan to harvest again. Thus, an additional 103,600 acres should also be withdrawn from the timber producing base. This subtraction further reduces the base timber-producing acreage to 2,485,400 acres or 56 percent of the privately held commercial forest land in the three-state region.

These 2.5 million acres that have been defined as the timber-producing land base are not static. Land now owned by an owner who is opposed to harvesting may be sold to one who is not opposed, and vice-versa. But the data and analysis indicate that this is now the proportion of Southern New England's privately owned commercial forest land that is growing timber that can realistically be considered available for harvesting.

How much volume and how much net annual growth does this acreage represent? There is no evidence to indicate that the timber-growing base is more productive or more heavily stocked than the average of all private commercial forest land in Southern New England. Therefore, we can say that, since 56 percent of the forest land is available, 56 percent of the timber volume and 56 percent of the growth are also available.

There is, according to the most recent forest survey of Southern New England, a total of 5,348 million cubic feet of growing stock on private commercial forest land in the three states *(Kingsley 1975)*. This means that there are 2,984 million cubic feet of growing stock on that portion of this land considered here as the timber-producing base. Applying this same logic to net annual growth, we estimate that this land produced about 103 million cubic feet of growth in 1971. This volume could be considered the maximum that could be harvested annually over a sustained period of time from the presently available timber base without materially affecting the condition of the forest.

By this system of logic, then, we can say that the realistic maximum volume of timber available from privately owned commercial forest land is nearly 3 billion cubic feet or 56 percent of the total volume on private land.

A minimum estimate can be obtained by looking at what owners say they intend to do. The owners of 804,000 acres report that they plan to harvest timber at some time during the coming decade. Since these people have rather definite plans, it seems reasonable to assume that they own mostly larger timber and larger tracts. To estimate the volume held by these owners, we have eliminated from consideration the volume and growth in stands with an average diameter of less than 5 inches dbh. This means that these lands are growing timber at the rate of 61 cubic feet per acre and in total produce 49 million cubic feet annually. If we can assume that all of these owners are successful in harvesting, this volume could be considered the minimum volume available annually. Another way to look at this is to coin a term and call this the "volume offered for harvesting annually".

That this indeed may be the volume offered annually is borne out by the estimates of timber harvested annually in Southern New England during the period 1952-71. During this

20-year time span, the average volume of timber harvested in the three states was 42 million cubic feet per year. Significantly, however, 24 million cubic feet of this average annual harvest was not utilized in any way. This is borne out by the fact that land-clearing is one of the most common reasons for harvesting timber in Southern New England. Thus it would appear that, at least during the 1952-71 period, Southern New England inadvertently harvested more timber than there was demand for.

In summary, we feel that annually one may expect that approximately 50 million cubic feet of growing stock will be offered for harvesting in New England. This is about twice the volume demanded for forest products, because of the extensive harvesting that is done as land-clearing. Should the demand for timber increase to such a degree that one would wish to know how much timber could be harvested in Southern New England annually, we would put this upper limit at about 90 million cubic feet. To harvest more than this would require a massive selling and re-education program for stimulating greater production by land owners.

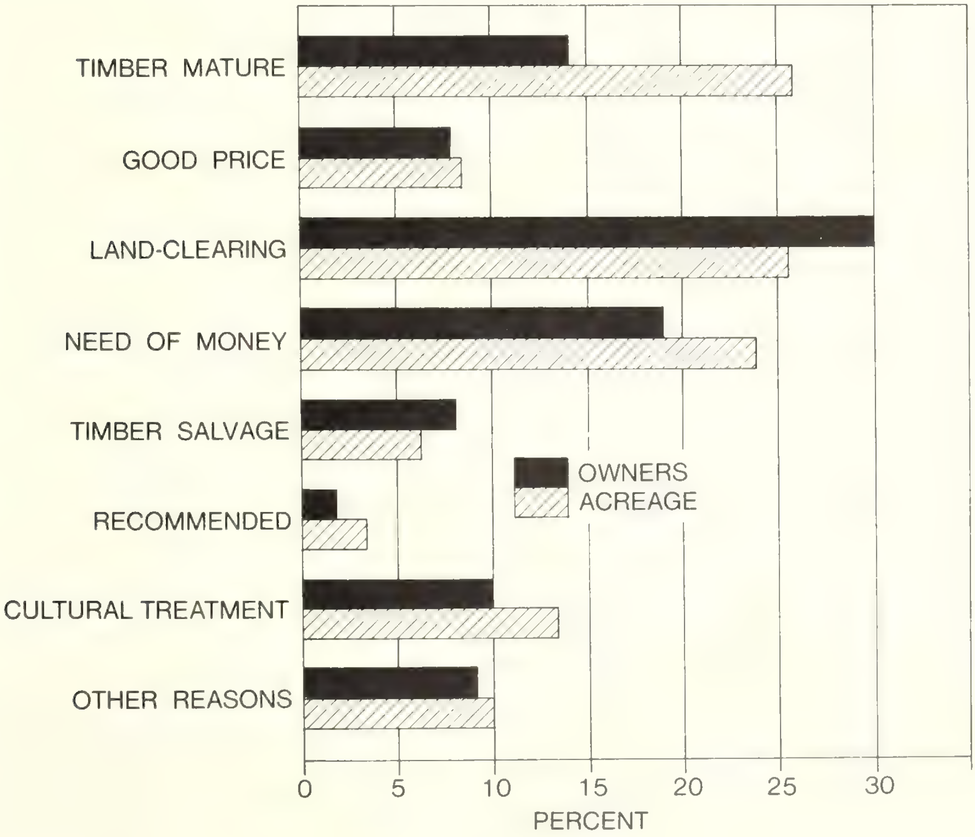
Why Owners Harvest Timber

The most common reason given by forest-land owners for harvesting timber was land-clearing. Thirty percent of those owners who harvested timber indicated land-clearing as their reason for doing so. However, these owners own only 11 percent of all the land held by owners who have harvested timber.

Owners of 26 percent of the land held by past harvesters said they harvested their timber because it was mature. They account for 14 percent of the owners who harvested. Another 19 percent of the owners who have harvested, and who own 24 percent of the land, did so because they needed money.

Ten percent of the owners harvested timber

Figure 4.—Reasons for harvesting timber, by percentage of owners and acreage.



as part of a timber-stand cultural treatment. These owners hold 13 percent of the forest land held by owners who have harvested. Three reasons for harvesting—timber salvage, harvesting recommended by a forester, and cultural treatment—all imply a conscious effort on the part of the owner to improve the condition of his forest land. All together, 20 percent of those Southern New England owners who have harvested timber did so for one of these reasons. They own 22 percent of the forest land held by harvesting owners (fig. 4).

Why Owners Do NOT Harvest Timber

In Southern New England, 87 percent of the owners have never harvested timber from their land. These people own 69 percent of the region's privately owned commercial forest land. More than a fourth of these people have not harvested timber because of a fear that harvesting would destroy the scenery. Another 20 percent have not harvested because they feel that their timber is immature.

Less than 3 percent of the nonharvesting owners did not harvest timber because they either did not trust loggers or were opposed to the cutting of trees for one reason or another. Such owners account for only 4 percent of the land owned by owners who have not harvested timber.

It is interesting to note that only 13 percent of the owners of privately held commercial forest land have ever harvested timber, but that 30 percent of the region's forest-land owners say they intend to harvest timber in the future. However, only 9 percent of these people could say that they intend to harvest timber in the next 10 years.

Predicting Owner Behavior

What an owner will do or intends to do with his forest land is influenced by many factors. To predict which owners in Southern New England are most likely to harvest timber in the future, we have used a multivariable analysis technique called AID III *(Sonquist et al 1971)*. To use this technique, it is first necessary to remove from the data all those questionnaires on which the respondent failed to answer the question that dealt with his intention to harvest or not to harvest timber. The remaining and usable samples then represent 172,400 forest-land owners and 4,196,100 acres of privately owned commercial forest land.

Because people plan their actions for different periods of time, it is necessary to ask not only if an owner intends to harvest timber, but also when he intends to do it. The respondent could answer this question in any one of four possible ways: (1) in the next 5 years; (2) in 5 to 10 years; (3) possibly at some unspecified future time; and (4) never.

Twenty-two variables were tested to determine which would most accurately predict the owner's future intentions about harvesting. The owner's response to the question—"Which of the following do you feel will be the most important benefits you expect to derive from your woodland in the next 5 years?"—proved to be the most consistent predictor. There were five possible answers to this question: (1) recreation; (2) income from the sale of timber; (3) increase in land value; (4) esthetics; and (5) any other. If the respondent indicated more than one of the five he was also asked to rank his choices.

Twenty-one categories were created, based on the two most important benefits indicated by the respondent. These 21 categories were then sorted into three major groups:

Group I: This includes a high percentage of owners who intend to harvest in each of the three time frames. There are an estimated 4,900 owners owning 209,300 acres in this group.

Group II: This includes a low percentage of owners who intend to harvest within the next 10 years, but a higher percentage who intend to harvest at some indefinite future date. There are an estimated 49,600 owners holding 1,655,400 acres in this group.

Group III: This includes a low percentage of owners who intend to harvest in any of the three time frames. There are an estimated 117,900 owners with 2,331,400 acres in this group.

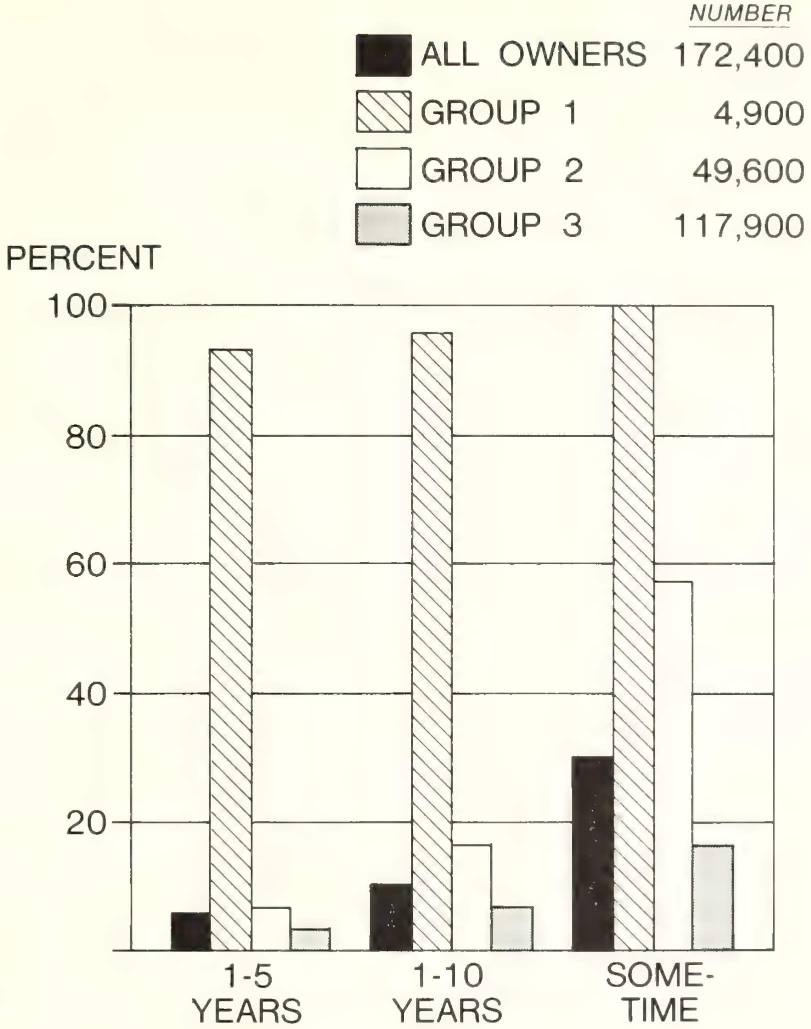


Figure 5.—Percentage of owners who intend to harvest timber, by expected time of harvest.

In Group I, 92 percent of the owners intend to harvest timber within the next 5 years, 94 percent within the next 10 years, and 100 percent sometime in the future. In Group II only 7 percent plan to harvest in the next 5 years and 15 percent within the next 10 years; but 59 percent intend to harvest sometime in the indefinite future. Group III, the largest of the three groups, contains only 15 percent who ever intend to harvest timber (fig. 5).

In general, those owners who anticipated that the most important future benefit they would derive from forest-land ownership would involve a real or perceived monetary gain were more likely to reply that they intend to harvest timber in the future. Real monetary gain involves income from the sale of timber, and a perceived monetary gain would be the feeling that the land has or will increase in value. Conversely, those owners who said that they expected the most important future benefits they would derive from their land would be nonmonetary in nature, such as esthetic enjoyment and recreation, were least likely to plan a timber harvest.

When we compare the three groups, several interesting patterns or characteristics of each group emerge; and other expected characteristics fail to emerge. Owners in Group I generally own more land than those in Group II and Group III. In fact, acreage declines appreciably from Group I to Group III. Group I owners average 43 acres, Group II 33 acres, and Group III 20 acres. Group I owners, on average, have owned their land for more than 10 years. But so have the Group III owners. Group II owners have owned theirs for less than 10 years, and these are also the most indefinite owners. Group I owners average more than 50 years old, while owners in Groups II and III average less than 50. Group I owners typically come from rural backgrounds, while Group II owners are either from a town or rural background, and Group III owners typically are from a town or city background. Many other owner characteristics such as educational level, occupation, or income appear—at least in Southern New England—to have little or nothing to do with whether or not an owner intends to harvest timber.

From this we can say that, the more land an owner owns, the older he is, and the more rural a background he grew up in, the more likely he is to harvest timber.

SOME ASPECTS OF FOREST MANAGEMENT ON PRIVATE OWNERSHIPS

Harvesting Practices

Southern New England forest-land owners apparently live up to the reputation that all New Englanders have of being independent. Forty-six percent of the owners who harvested timber selected for themselves which trees would be cut. Only 10 percent had a forester select the timber, and another 10 percent assisted a forester in selecting the trees. Either the landowner or a forester or both together selected which trees would be cut on 66 percent of the ownerships on which harvesting occurred. These ownerships accounted for 58 percent of the acreage held by owners who have harvested.

The timber buyer selected the timber to be harvested on 21 percent of the ownerships, and this accounted for 24 percent of the acreage owned by harvesting owners. Another 7 percent of the owners, who own 10 percent of the land held by harvesters, selected the timber with the "assistance" of the buyer.

The selection system is the most popular method of timber harvesting in Southern New England. This method was used by 27 percent of the owners who harvested timber. These owners account for more than 467 thousand acres or 34 percent of the land held by harvesters. The diameter-limit method accounted for 28 percent of the land held by harvesters, and clearcutting accounted for only 12 percent. The relatively small acreage involved with clearcutting is most likely a reflection of the fact that there is no large active pulpwood market in most of this region. Clearcutting is more common in regions that produce substantial volumes of pulpwood.

More owners harvested sawlogs than any other timber product—15,000 owners who own a total of more than 1 million acres. Other products, including fireplace wood, were harvested by 9,800 owners who own more than half a million acres.

Forestry Assistance

Of the 184,100 owners of commercial forest land in Southern New England, only 20,000—11 percent—have ever sought forestry assistance. These owners account for 25 percent of the private forest land in the region. Even more surprising is the fact that 63 percent of the owners (who account for 45 percent of the land) replied that they did not know what agency to contact for forestry assistance. Undoubtedly many of these owners hold small tracts and have not perceived a need for forestry assistance.

The Connecticut Department of Environmental Protection, Forestry Unit; the Massachusetts Department of Natural Resources; and the Rhode Island Department of Natural Resources are the three agencies that are responsible for providing forestry assistance to landowners in the region. Only 18 percent of the owners of forest land in Southern New England said that they would contact "the state" for forestry assistance. These owners account for 28 percent of the privately owned commercial forest land in the region. These owners and those owners who said they did not know who to contact for assistance account for 81 percent of the owners and 73 percent of the private commercial forest land. The remaining 19 percent of the owners mentioned various agencies such as the USDA Cooperative Extension Services, "the county," the USDA Forest Service, a consulting forester, and many others. Since most of these agencies cooperate to some degree in landowner assistance programs, they would undoubtedly put the landowner in touch with the proper agency. A consulting forester could provide the service.

Of the 20,000 owners who received forestry services, 5,900 received assistance with tree planting. While this was the highest proportion of owners who received any kind of assistance, the 5,100 owners who sought assistance for timber-stand improvement owned the largest acreage, 268,600 acres; and the 2,900 who received assistance for general forest management owned 252,800. Tree planters owned 240,500 acres.

Recreation on Private Forest Land

Nearly one-third of the privately owned commercial forest in Southern New England is posted either against all forms of trespassing or against hunting specifically. Apparently many more owners do not knowingly permit public use, although they do not post their land, since the highest permitted use—hiking—is permitted on only 48 percent of the private commercial forest land.

Picnicking is permitted on 33 percent of the acreage, fishing on 30 percent, and camping on 26 percent. While hunting is permitted by only one owner in four, these are obviously the larger owners, because hunting is permitted on 37 percent of the private commercial forest land.

INTRODUCING "SAM YANKEE"

Now that we've discussed the who's, what's, and why's of the forest-land owners of Southern New England, we can describe the typical Southern New England forest-land owner. Like all such "average" characters, he doesn't really exist. So to make him seem a little more real we'll call him "Sam Yankee."

Sam is more than 60 years old and has an income of more than $10,000 per year. He has 12 years of formal education and grew up in a city of more than 15,000 people. Sam has owned his forest land, which consists of less than 10 acres, for more than 10 years. His forest land is part of his residence, although recreation and the increasing value of the land are also important reasons why he owns it. In the past the most important benefit Sam has derived from his land was esthetic enjoyment. He also expects this to be the most important benefit he'll derive from it in the future.

Sam has never harvested timber from his land because he feels that that would destroy the scenery. He has never contacted anyone about forestry assistance. Also, he is not inclined to let the general public use his land for any form of recreation.

IN CONCLUSION

For timber production, Southern New England's privately owned commercial forest land is greatly underutilized. And, given the present attitudes of its 184,000 owners, it is highly unlikely that a greater portion of its potential will be realized in the near future. Further, the highly fragmented ownership pattern of the private portion of the region's commercial forest land would seem to preclude full utilization of the land's productive potential.

The overwhelming majority of forest-land owners in the region hold forest land for reasons not related to monetary or material gain. Few have definite plans to harvest timber. This indicates that the primary function of forest land in Southern New England is its use for amenity and environmental values. Forested land forms an integral part of the living environment; and judging from the responses and attitudes expressed by many of the respondents to this study, it is generally a cherished part of the environment.

Even though few Southern New England owners have harvested timber in the past, most owners do not seem to be unalterably opposed to harvesting timber. This would lead to the conclusion that much of the forest potential is going unutilized by default or in some cases through the mistaken notion that cutting timber would not benefit the forest. It seems that the productive potential of the region's private forest land might be increased if owners could be made aware that judicious and limited timber harvesting could serve to protect and enhance the very values they derive from their forest land while at the same time helping to defray the costs of forest-land ownership.

The owners of only 25 percent of the region's private forest land have sought forestry assistance. This brings up the question: How many of the other owners have not sought assistance because they assume that forestry is related only to timber production? Forestry programs are often designed to serve many different ownership objectives. Through more effort given to educational programs, owners could be made aware of this. Frequently, to achieve such forest-management objectives as wildlife-habitat improvement, esthetic improvements, and increased recreational values, it is necessary to harvest timber. Thus, even while achieving other objectives, forest management could still help bring about a gain in timber production.

One might well ask: Why be concerned with possible ways of increasing timber production when the region is presently removing more timber from the forest base than is demanded for products? Two hidden factors seem to be at work here. One is that, because of land-use changes and land-clearing, the forest land base of the region is shrinking. Another is that there is much evidence to indicate that we can expect the demand for wood and other renewable resources to increase throughout the world in coming decades.

As supplies of non-renewable resources such as oil and minerals become more and more scarce, technologies will need to be developed to supply chemicals and plastics from renewable and biodegradable sources. In many instances these sources mean wood. Also, wood in its traditional forms as lumber, plywood, and paper may be put to uses which in today's world are exclusively the domain of nonrenewable resources. Because forests improve slowly, and old attitudes die hard, we ought to be thinking now of what to do and how to do it in the future, even though the need may seem remote.

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APPENDIX

I

Study Method

The sampling scheme used in this study was derived from the sampling design used in the forest survey by the Northeastern Station. Forest-survey field crews attempted to obtain the correct name and mailing address of the owner of each of the 619 privately owned forested field plots in the three States. In addition, they attempted to obtain the names of persons owning land pinpointed on 1,146 randomly located photo-interpretation points on aerial photographs of the three States. The field crews were able to obtain usable addresses for nearly 90 percent of the field plots and photo points. A total of 1,863 questionnaires were mailed to owners of commercial forest land in Southern New England. A total of 1,091 were returned with usable information.

The questionnaire used in this study was developed after investigation of several earlier ownership studies and consultations with other investigators. It was field-tested before the mass mailings. The mailing consisted of the questionnaire plus a cover letter explaining the purpose of the survey. Approximately 2 weeks after the first mailing, those addressees who had not responded were mailed a second copy of the questionnaire and the cover letter plus a second letter urging cooperation with the study. Approximately 1 month later, 782 owners had responded. Then a 100-percent field canvass of non-respondents was undertaken. This effort resulted in an additional 246 usable questionnaires.

The resulting data were compiled by electronic computer, using the FINSYS generalized computer system. (Wilson, Robert W., Jr., and Robert C. Peters, 1967. The Northeastern Forest Inventory Data Processing System. I. Introduction. USDA For. Serv. Res. Paper NE-61. 20 p., illus.)

Since the sampling scheme used in this study is essentially the one used in the forest survey of timber resources, it introduces a bias because the sample is proportional to the forest area being sampled and is not proportional to the number of owners of forest land. To overcome this bias, it was necessary to weight the numbers of owners obtained in the sample. This procedure can be stated mathematically as:

$$wx = \frac{CFLp/Nr}{Ai}$$

and

Σwx = estimated numbers of private owners in the State

where

wx = the weighted number of private owners represented by the respondent.

$CFLp$ = the area of privately owned commercial forest land in the State.

Nr = number of respondents in the survey.

Ai = acres owned by individual respondent.

The sum of the weighted number of owners then provides a statistically unbiased estimate of the total number of persons who own commercial forest land in Southern New England.

The acreage of commercial forest land was estimated in a manner similar to that used in the forest survey. The total area of privately owned commercial forest land in each State was divided by the number of field plots represented in the ownership canvass. Thus, if a particular respondent owned land on which one forested plot was located, his response was given a weight of one. If a respondent represented two forested plots, his response received a weight of two or double the acreage and so on. Actual reported acreage was used only to calculate the sample mean, mode, and median.

It was also necessary to determine if those questionnaires obtained through the mail and those obtained by means of the field follow-up were both samples of the same population. The hypothesis tested was that there was no significant difference in the mean acreage of the subsamples. Student's t-test showed that no significant difference existed at the 99-percent probability level.

Because this study encompasses a three-state region, it was necessary to make the calculations for each of the three states and then sum the results. The following tabulation shows the pertinent data for each of the States:

	Questionnaires mailed (No.)	*Usable returned questionnaires (No.)*	*Acreage per plot (Acres)*
Connecticut	801	486	3,386
Massachusetts	676	393	6,020
Rhode Island	386	212	1,761
All states	1,863	1,091	—

II

Sampling Errors

Sampling errors were calculated for the estimated total number of forest-land owners in each of the three States and for the combined total. The sampling error for the number of acres of commercial forest land in private ownership was calculated as part of the forest survey. These sampling errors are presented below. The user of these data is cautioned that, as the size of any estimate decreases in relation to the total estimate, the sampling error, expressed as a percentage of the estimate, increases drastically. Sampling error for:

State	*Acres of private commercial forest land*	*Number of owners of private commercial forest land*
Massachusetts	±48,600 (±2.0%)	±13,010 (±12%)
Connecticut	±38,200 (±2.3%)	± 6,590 (±10%)
Rhode Island	±11,600 (±3.1%)	± 2,300 (±16%)
Total	±62,500 (±1.4%)	±14,764 (± 8%)

For a discussion of the method of calculating these sampling errors, see: Cochran, William G. 1963. Sampling techniques. 2nd ed., 252 p. John Wiley & Sons, Inc., New York.

III

Definitions of Terms

Forest land.—Land that is at least 16.7 percent stocked (contains at least 7.5 square feet of basal area) with forest trees of any size, or that formerly had such tree cover and is not currently developed for nonforest use. (Forest trees are woody plants that have a well-developed stem and usually are more than 12 feet in height at maturity.) The minimum area for classification of forest land is 1 acre.

Commercial forest land.—Forest land that is producing or capable of producing crops of industrial wood (more than 20 cubic feet per acre per year) and is not withdrawn from timber utilization. (Industrial wood: all roundwood products except fuelwood.)

Private commercial forest land.—All commercial forest land other than that owned by Federal, state, or local governments or their agencies.

Softwoods.—Coniferous trees that are mostly evergreen, having needles or scalelike leaves.

Hardwoods.—Dicotyledonous trees that are usually broad-leaved and deciduous.

Stand.—A growth of trees on a minimum of 1 acre of forest land that is at least 16.7 percent stocked with forest trees of any size.

Growing-stock trees.—Live trees of commercial species that are classified as sawtimber, poletimber, saplings, and seedlings; that is, all live trees of commercial species except rough and rotten trees.

Growing-stock volume.—Net volume, in cubic feet, of live growing-stock trees that are 5.0 inches dbh and over, from a 1-foot stump to a minimum 4.0-inch top diameter outside bark of the central stem. Net volume equals gross volume less deduction for rot or sweep and crook.

Sawtimber trees.—Live trees of commerical species: (a) that are of the following minimum diameter at breast height: softwoods 9.0 inches and hardwoods 11.0 inches; and (b) that contain at least one 12-foot or two noncontiguous 8-foot merchantable sawlogs and meet regional specifications for freedom from defect.

Sawtimber volume.—Net volume in board feet, International ¼-inch rule, of merchantable sawlogs in live sawtimber trees. Net volume equals gross volume less deductions for rot, sweep, and other defects that affect use for lumber.

Board foot.—A unit of lumber measurement 1 foot long, 1 foot wide, and 1 inch thick, or its equivalent. By forest-survey convention, softwoods less than 9.0 inches dbh and hardwoods less than 11.0 inches dbh do not contain board-foot volume.

Annual net growth.—The annual change (resulting from natural causes) in volume of sound wood in sawtimber and poletimber trees.

Timber removal.—The volume of growing stock or sawtimber trees harvested or killed in logging or in cultural operations such as timber-stand improvement, land-clearing, or changes in land use.

Forest industries.—Companies or individuals operating wood-using plants.

Timber salvage.—Removal of down, damaged, or diseased trees.

Selection system.—The method of timber harvesting in which usually only the oldest or largest trees in a stand are harvested. Trees are taken singly or in small groups, but the entire stand is never cleared off completely.

Clearcutting.—The method of timber harvesting in which the area is cut clear in the literal sense of the word; virtually all the trees, large and small, are removed. The term is often erroneously applied to any type of cutting in which all the merchantable timber is removed and all that is not merchantable is left.

Diameter limit.—The method of timber harvesting in which all trees above a specified diameter are removed.

Sawlog.—Any log from which lumber is to be sawed.

Veneer log.—Any log from which veneer is to be made either by peeling (rotary cut) or slicing.

Pulpwood.—Any log from which woodpulp is to be made. Usually measured in bolts of 4, 5, or 8 feet and somewhat smaller in diameter than either sawlogs or veneer logs.

IV

Tabular Data

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Table 1.—Estimated number of private owners of commercial forest land

Size-class (acres)	Massachusetts		Connecticut		Rhode Island		Total	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*
				OWNERS				
1-9	62,800	60	36,100	55	6,700	47	105,600	58
10-19	14,200	14	9,900	15	2,400	17	26,500	14
20-49	14,100	14	10,900	16	2,800	20	27,800	15
50-99	7,100	7	5,800	9	1,500	11	14,400	8
100-199	4,100	4	2,500	4	600	4	7,200	4
200-499	1,300	1	700	1	200	1	2,200	1
500+	300	(**)	100	(**)	(*)	(**)	400	(**)
Total	103,900	100	66,000	100	14,200	100	184,100	100
				ACRES OWNED				
1-9	192,600	8	152,400	9	21,800	6	366,800	8
10-19	180,600	7	132,000	8	29,100	8	341,700	8
20-49	433,500	18	328,400	20	83,500	23	845,400	19
50-99	487,700	20	397,500	24	94,400	26	979,600	22
100-199	523,800	22	314,900	19	72,600	20	911,300	20
200-499	373,300	15	207,100	12	43,600	12	624,000	14
500+	240,800	10	126,700	8	18,200	5	385,700	9
Total	2,432,300	100	1,659,000	100	363,200	100	4,454,500	100

*Fewer than 50 owners.

**Less than 0.5 percent.

Table 2.—Form of forest-land ownership

Form of ownership	Owners		Acreage owned		Owners who have harvested timber	Acreage owned
	No.	*Pct.*	*Acres*	*Pct.*	*Pct.*	*Pct.*
			MASSACHUSETTS			
Individuals	87,800	85	1,860,300	76	14	36
Corporations	8,700	8	307,000	13	18	43
Partnerships	4,500	4	102,300	4	8	41
Other	2,900	3	162,700	7	34	37
Total	103,900	100	2,432,300	100	15	37
			CONNECTICUT			
Individuals	61,200	93	1,323,700	80	10	25
Corporations	1,500	2	172,700	10	39	35
Partnerships	1,100	2	67,700	4	6	10
Other	2,200	3	94,900	6	6	29
Total	66,000	100	1,659,000	100	11	26
			RHODE ISLAND			
Individuals	12,900	91	293,300	81	4	16
Corporations	900	6	42,700	12	5	4
Partnerships	100	1	5,100	1	—	—
Other	300	2	22,100	6	5	15
Total	14,200	100	363,200	100	4	14
			ALL STATES			
Individuals	161,900	88	3,477,300	78	12	30
Corporations	11,100	6	522,400	12	20	36
Partnerships	5,700	3	175,100	4	7	28
Other	5,400	3	279,700	6	20	33
Total	184,100	100	4,454,500	100	13	31

Table 3.—Occupations of individual forest-land owners

Occupation	Massachusetts		Connecticut		Rhode Island		Total	
				OWNERS				
	No.	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*
Professional	11,000	13	10,800	18	2,000	16	23,800	15
Executive	17,700	20	7,200	12	1,600	12	26,500	16
Retired	15,100	17	10,400	17	4,600	36	30,100	19
White collar	14,600	17	7,000	11	700	5	22,300	14
Skilled labor	17,900	20	15,200	25	1,800	14	34,900	21
Farmer	2,600	3	3,100	5	500	4	6,200	4
Other	8,900	10	7,500	12	1,700	13	18,100	11
Total	87,800	100	61,200	100	12,900	100	161,900	100
				ACREAGE OWNED				
	Acres	*Pct.*	*Acres*	*Pct.*	*Acres*	*Pct.*	*Acres*	*Pct.*
Professional	253,100	14	247,300	18	56,800	19	557,200	16
Executive	392,300	21	186,400	14	28,400	10	607,100	17
Retired	373,300	20	308,100	23	90,800	31	772,200	22
White collar	234,100	12	156,000	12	24,600	8	414,700	12
Skilled labor	221,500	12	156,000	12	28,400	10	405,900	12
Farmer	202,500	11	117,900	10	24,600	8	345,000	10
Other	183,500	10	152,000	11	39,700	14	375,200	11
Total	1,860,300	100	1,323,700	100	293,300	100	3,477,300	100

Table 4.—Corporate ownerships of forest land

Type of corporation	Massachusetts		Connecticut		Rhode Island		Total	
				OWNERS				
	No.	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*
Real estate	900	10	300	20	200	22	1,400	13
Corporate farm	200	2	100	7	—	—	300	3
Forest industry	400	5	—	—	—	—	400	4
Other industry	3,100	36	300	20	200	22	3,600	32
Other corporations	4,100	47	800	53	500	56	5,400	48
Total	8,700	100	1,500	100	900	100	11,100	100
				ACREAGE OWNED				
	Acres	*Pct.*	*Acres*	*Pct.*	*Acres*	*Pct.*	*Acres*	*Pct.*
Real estate	51,200	17	58,700	34	13,600	32	123,500	24
Corporate farm	51,200	17	10,400	6	—	—	61,600	12
Forest industry	25,600	8	—	—	—	—	25,600	5
Other industry	86,500	28	71,700	42	22,900	54	181,100	34
Other corporations	92,500	30	31,900	18	6,200	14	130,600	25
Total	307,000	100	172,700	100	42,700	100	522,400	100

Table 5.—Age class of individual forest-land owners

Age class (years)	Owners		Commercial forest land owned	
	No.	*Pct.*	*Acres*	*Pct.*
Under 40	32,500	20	433,300	12
40 to 49	41,800	26	713,500	21
50 to 59	36,000	22	943,400	27
Over 60	51,600	32	1,387,100	40
Total	161,900	100	3,477,300	100

Table 6.—Education level of forest-land owners

Education level	Owners		Commercial forest land owned	
	No.	*Pct.*	*Acres*	*Pct.*
0 to 8 years	29,800	18	611,300	18
9 to 12 years	73,700	46	1,355,800	39
1 to 4 years of college	31,500	19	742,400	21
More than 4 years of college	26,900	17	767,800	22
Total	161,900	100	3,477,300	100

Table 7.—Income level of forest-land owners

Income category (annual)	Owners		Commercial forest land owned	
	No.	*Pct.*	*Acres*	*Pct.*
Under $10,000	68,300	42	1,362,100	39
$10,000 to $30,000	63,300	39	1,319,600	38
Over $30,000	30,300	19	795,600	23
Total	161,900	100	3,477,300	100

Table 8.—Early life environment of forest-land owners

Type of environment [a]	Owners		Commercial forest land owned	
	No.	*Pct.*	*Acres*	*Pct.*
City over 100,000 population	32,800	20	696,100	20
City of 15,000 to 100,000 population	41,100	26	678,100	20
Town under 15,000 population	37,400	23	918,400	26
Rural area	50,600	31	1,184,700	34
Total	161,900	100	3,477,300	100

[a] First 12 years of life.

Table 9.—Length of ownership of forest land by individual owners

Period of ownership (years)	Owners		Commercial forest land owned	
	No.	*Pct.*	*Acres*	*Pct.*
Less than 5	32,400	18	603,100	14
5 to 9	45,500	25	950,600	21
10 to 24	59,600	32	1,605,400	36
25 or more	46,600	25	1,295,400	29
Total	184,100	100	4,454,500	100

Table 10.—Distance of owner's residence from his forest land

Distance from tract	Owners		Commercial forest land owned	
	No.	*Pct.*	*Acres*	*Pct.*
Lives on property or within 5 miles	159,900	87	3,608,600	81
6 to 15 miles	14,400	8	339,400	8
More than 15 miles	9,800	5	506,500	11
Total	184,100	100	4,454,500	100

Table 11.—Number of forest tracts owned by all groups of owners

Tracts owned (number)	Owners		Commercial forest land owned	
	No.	*Pct.*	*Acres*	*Pct.*
1	159,000	86	3,203,700	72
2	21,000	12	692,700	16
3 or more	4,100	2	558,100	12
Total	184,100	100	4,454,500	100

Table 12.—Reasons for owning forest land

Reason	Massachusetts		Connecticut		Rhode Island		Total	
				OWNERS				
	No.	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*
Land investment	17,000	16	12,400	19	2,100	15	31,500	17
Recreation	16,800	16	12,800	19	1,800	13	31,400	17
Timber production	3,800	4	4,000	6	600	4	8,400	4
General farm use	9,300	9	6,100	9	2,200	16	17,600	10
Part of the residence	42,400	41	23,400	36	5,500	38	71,300	39
Other	14,600	14	7,300	11	2,000	14	23,900	13
Total	103,900	100	66,000	100	14,200	100	184,100	100
				ACREAGE OWNED				
	Acres	*Pct.*	*Acres*	*Pct.*	*Acres*	*Pct.*	*Acres*	*Pct.*
Land investment	458,900	19	327,200	20	70,500	19	856,600	19
Recreation	499,000	21	359,700	22	66,500	18	925,200	21
Timber production	244,800	10	106,300	6	20,000	5	371,100	8
General farm use	289,900	12	192,200	12	49,800	14	531,900	12
Part of the residence	643,200	26	449,800	27	111,000	31	1,204,000	27
Other	296,500	12	223,800	13	45,400	13	565,700	13
Total	2,432,300	100	1,659,000	100	363,200	100	4,454,500	100

Table 13.—Reasons for owning forest land by owners who have harvested timber

Reason	Massachusetts		Connecticut		Rhode Island		Total	
OWNERS								
	No.	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*
Land investment	1,700	11	1,100	16	200	32	3,000	13
Recreation	2,600	17	1,400	20	*	**	4,000	18
Timber production	1,700	11	600	8	100	17	2,400	10
General farm use	2,400	16	1,000	14	100	17	3,500	15
Part of the residence	5,400	35	2,400	34	100	17	7,900	34
Other	1,600	10	600	8	100	17	2,300	10
Total	15,400	100	7,100	100	600	100	23,100	100
ACREAGE OWNED								
	Acres	*Pct.*	*Acres*	*Pct.*	*Acres*	*Pct.*	*Acres*	*Pct.*
Land investment	141,400	16	63,100	15	10,600	21	215,100	16
Recreation	168,500	19	85,100	20	7,700	15	261,300	19
Timber production	163,000	18	52,900	12	7,600	15	223,500	16
General farm use	135,900	15	76,300	18	7,300	14	219,500	16
Part of the residence	201,300	22	98,300	23	15,000	29	314,600	23
Other	87,000	10	54,300	12	3,000	6	144,300	10
Total	897,100	100	430,000	100	51,200	100	1,378,300	100

* Fewer than 50 owners.

** Less than 0.5 percent.

Table 14.—Reasons for owning forest land by owners who have not harvested timber

Reason	Massachusetts		Connecticut		Rhode Island		Total	
OWNERS								
	No.	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*
Land investment	15,300	17	11,300	19	1,900	14	28,500	18
Recreation	14,200	16	11,400	19	1,800	13	27,400	17
Timber production	2,100	2	3,400	6	500	4	6,000	4
General farm use	6,900	8	5,100	9	2,100	16	14,100	9
Part of the residence	37,000	42	21,000	36	5,400	39	63,400	39
Other	13,000	15	6,700	11	1,900	14	21,600	13
Total	88,500	100	58,900	100	13,600	100	161,000	100
ACREAGE OWNED								
	Acres	*Pct.*	*Acres*	*Pct.*	*Acres*	*Pct.*	*Acres*	*Pct.*
Land investment	317,500	21	264,100	22	59,900	19	641,500	21
Recreation	330,500	21	274,600	22	58,800	19	663,900	21
Timber production	81,800	5	53,400	4	12,400	4	147,600	5
General farm use	154,000	10	115,900	9	42,500	14	312,400	10
Part of the residence	441,900	29	351,500	29	96,000	31	889,400	29
Other	209,500	14	169,500	14	42,400	13	421,400	14
Total	1,535,200	100	1,229,000	100	312,000	100	3,076,200	100

Table 15.—Benefits derived by forest-land owners in the last 5 years and benefits expected in the next 5 years

Benefit	Last 5 years				Next 5 years			
	Owners		Commercial forest land owned		Owners		Commercial forest land owned	
	No.	*Pct.*	*Acres*	*Pct.*	*No.*	*Pct.*	*Acres*	*Pct.*
OWNERS WHO HARVESTED								
Recreation	4,900	3	305,800	7	4,800	3	326,500	7
Sale of timber	3,000	2	228,800	5	3,700	2	213,100	5
Land-value increase	4,500	2	314,300	7	5,000	3	356,400	8
Esthetics	9,800	5	445,700	10	8,500	4	393,000	9
Other	900	1	83,700	2	1,100	1	89,300	2
Total	23,100	13	1,378,300	31	23,100	13	1,378,300	31
OWNERS WHO HAVE NOT HARVESTED								
Recreation	32,500	17	750,300	17	33,900	18	739,200	17
Sale of timber	—	—	—	—	4,200	2	127,100	3
Land-value increase	43,400	24	805,300	18	47,000	26	884,700	20
Esthetics	75,800	41	1,282,200	29	64,200	35	1,087,400	24
Other	9,300	5	238,400	5	11,700	6	237,800	5
Total	161,000	87	3,076,200	69	161,000	87	3,076,200	69
ALL OWNERS								
Recreation	37,400	20	1,056,100	24	38,700	21	1,065,700	24
Sale of timber	3,000	2	228,800	5	7,900	4	340,200	8
Land-value increase	47,900	26	1,119,600	25	52,000	29	1,241,100	28
Esthetics	85,600	46	1,727,900	39	72,700	39	1,480,400	33
Other	10,200	6	322,100	7	12,800	7	327,100	7
Total	184,100	100	4,454,500	100	184,100	100	4,454,500	100

Table 16.—Benefits derived and benefits expected by forest-land owners: MASSACHUSETTS

Benefit	Last 5 years				Next 5 years			
	Owners		Commercial forest land owned		Owners		Commercial forest land owned	
	No.	*Pct.*	*Acres*	*Pct.*	*No.*	*Pct.*	*Acres*	*Pct.*
				OWNERS WHO HARVESTED				
Recreation	3,200	3	197,800	8	2,900	3	206,800	9
Sale of timber	2,300	2	164,400	7	3,000	3	150,900	6
Land-value increase	2,800	3	211,700	9	3,100	3	243,200	10
Esthetics	6,700	7	275,800	11	5,900	6	248,700	10
Other	400	(*)	47,400	2	500	(*)	47,500	2
Total	15,400	15	897,100	37	15,400	15	897,100	37
				OWNERS WHO HAVE NOT HARVESTED				
Recreation	16,800	16	372,500	15	17,700	17	365,500	15
Sale of timber	—	—	—	—	3,000	3	79,800	3
Land-value increase	26,100	25	400,300	17	27,300	26	428,700	18
Esthetics	40,800	39	630,100	26	34,100	33	541,600	22
Other	4,800	5	132,300	5	6,400	6	119,600	5
Total	88,500	85	1,535,200	63	88,500	85	1,535,200	63
				ALL OWNERS				
Recreation	20,000	19	570,300	23	20,600	20	572,300	24
Sale of timber	2,300	2	164,400	7	6,000	6	230,700	9
Land-value increase	28,900	28	612,000	26	30,400	29	671,900	28
Esthetics	47,500	46	905,900	37	40,000	39	790,300	32
Other	5,200	5	179,700	7	6,900	6	167,100	7
Total	103,900	100	2,432,300	100	103,900	100	2,432,300	100

* Less than 0.5 percent.

Table 17.—Benefits derived and benefits expected by forest-land owners: CONNECTICUT

Benefit	Last 5 years				Next 5 years			
	Owners		Commercial forest land owned		Owners		Commercial forest land owned	
	No.	*Pct.*	*Acres*	*Pct.*	*No.*	*Pct.*	*Acres*	*Pct.*
OWNERS WHO HARVESTED								
Recreation	1,600	3	97,700	6	1,700	3	108,200	7
Sale of timber	700	1	56,800	4	700	1	54,800	3
Land-value increase	1,500	2	88,900	5	1,700	3	99,600	6
Esthetics	2,900	4	151,600	9	2,400	3	128,400	8
Other	400	1	35,000	2	600	1	39,000	2
Total	7,100	11	430,000	26	7,100	11	430,000	26
OWNERS WHO HAVE NOT HARVESTED								
Recreation	13,000	20	307,700	18	13,600	20	303,200	18
Sale of timber	—	—	—	—	1,000	2	39,700	3
Land-value increase	14,600	22	324,700	20	16,600	25	364,600	22
Esthetics	27,900	42	515,400	31	23,800	36	434,900	26
Other	3,400	5	81,200	5	3,900	6	86,600	5
Total	58,900	89	1,229,000	74	58,900	89	1,229,000	74
ALL OWNERS								
Recreation	14,600	23	405,400	24	15,300	23	411,400	25
Sale of timber	700	1	56,800	4	1,700	3	94,500	6
Land-value increase	16,100	24	413,600	25	18,300	28	464,200	28
Esthetics	30,800	46	667,000	40	26,200	39	563,300	34
Other	3,800	6	116,200	7	4,500	7	125,600	7
Total	66,000	100	1,659,000	100	66,000	100	1,659,000	100

Table 18.—Benefits derived and benefits expected by forest-land owners: **RHODE ISLAND**

Benefit	Last 5 years				Next 5 years			
	Owners		Commercial forest land owned		Owners		Commercial forest land owned	
	No.	*Pct.*	*Acres*	*Pct.*	*No.*	*Pct.*	*Acres*	*Pct.*
OWNERS WHO HARVESTED								
Recreation	100	1	10,300	3	200	1	11,500	3
Sale of timber	(*)	(**)	7,600	2	(*)	(**)	7,400	2
Land-value increase	200	1	13,700	4	200	2	13,600	4
Esthetics	200	1	18,300	5	200	1	15,900	4
Other	100	1	1,300	(**)	(*)	(**)	2,800	1
Total	600	4	51,200	14	600	4	51,200	14
OWNERS WHO HARVESTED								
Recreation	2,700	19	70,100	19	2,600	19	70,500	19
Sale of timber	—	—	—	—	200	1	7,600	2
Land-value increase	2,700	19	80,300	22	3,100	22	91,400	25
Esthetics	7,100	50	136,700	38	6,300	44	110,900	31
Other	1,100	8	24,900	7	1,400	10	31.600	9
Total	13,600	96	312,000	86	13,600	96	312,000	86
ALL OWNERS								
Recreation	2,800	20	80,400	22	2,800	20	82,000	22
Sale of timber	(*)	(**)	7,600	2	200	1	15,000	4
Land-value increase	2,900	20	94,000	26	3.300	24	105,000	29
Esthetics	7,300	51	155,000	43	6,500	45	126,800	35
Other	1,200	9	26,200	7	1,400	10	34,400	10
Total	14,200	100	363,200	100	14,200	100	363,200	100

*Fewer than 50 owners.

**Less than 0.5 percent.

Table 19.—Reasons for harvesting timber

Reason	Individuals[a]		Corporations		Other[b]		Total	
				OWNERS				
	No.	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*
Timber mature	2,800	14	200	9	300	20	3,300	14
Good price	1,400	7	100	5	400	26	1,900	8
Land-clearing	5,800	30	1,100	49	(*)	(**)	6,900	30
Need of money	3,900	20	100	5	300	20	4,300	19
Company use	300	2	(*)	(**)	(*)	(**)	300	2
Timber salvage	1,100	6	600	27	100	7	1,800	8
Recommended	400	2	—	—	100	7	500	2
Cultural treatment	2,200	11	100	5	100	7	2,400	10
Other	1,500	8	(*)	(**)	200	13	1,700	7
Total	19,400	100	2,200	100	1,500	100	23,100	100
				ACREAGE OWNED				
	Acres	*Pct.*	*Acres*	*Pct.*	*Acres*	*Pct.*	*Acres*	*Pct.*
Timber mature	272,500	26	58,400	30	25,300	18	356,200	26
Good price	65,900	6	18,000	9	21,500	16	105,400	8
Land-clearing	118,100	12	31,100	16	3,300	2	152,500	11
Need of money	271,000	26	22,500	11	31,100	23	324,600	24
Company use	11,500	1	10,900	6	3,300	2	25,700	2
Timber salvage	65,000	6	14,700	8	6,000	4	85,700	6
Recommended	41,600	4	—	—	6,000	4	47,600	3
Cultural treatment	126,400	12	31,100	16	25,500	19	183,000	13
Other	72,400	7	8,500	4	16,700	12	97,600	7
Total	1,044,400	100	195,200	100	138,700	100	1,378,300	100

*Fewer than 50 owners.
**Less than 0.5 percent.
[a] Includes joint ownerships.
[b] Includes partnerships, undivided estates, clubs, associations, etc.

Table 20.—Reasons for not harvesting timber

Reason	Individuals[a]		Corporations		Other		Total	
				OWNERS				
	No.	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*
Timber immature	29,300	21	800	9	1,900	20	32,000	20
No market for timber	6,000	4	(*)	(**)	100	1	6,100	4
Low price	1,000	1	100	1	(*)	(**)	1,100	1
Would destroy scenery	41,100	29	700	8	700	7	42,500	26
Distrust of loggers	600	(**)	(*)	(**)	—	—	600	(**)
Poor quality	8,000	6	3,000	34	700	7	11,700	7
Low volume	2,600	2	—	—	600	6	3,200	2
Insufficient area	16,300	11	—	—	3,800	40	20,100	13
Opposed to harvesting	2,800	2	(*)	(**)	300	3	3,100	2
Other	34,800	24	4,300	48	1,500	16	40,600	25
Total	142,500	100	8,900	100	9,600	100	161,000	100
				ACREAGE OWNED				
	Acres	*Pct.*	*Acres*	*Pct.*	*Acres*	*Pct.*	*Acres*	*Pct.*
Timber immature	614,900	25	44,100	13	90,600	29	749,600	25
No market for timber	119,600	5	12,300	4	2,900	1	134,800	4
Low price	52,100	2	19,300	6	4,600	2	76,000	2
Would destroy scenery	632,400	26	101,900	31	54,700	17	789,000	26
Distrust of loggers	36,800	2	6,900	2	—	—	43,700	1
Poor quality	145,600	6	22,900	7	24,800	8	193,300	6
Low volume	44,600	2	—	—	12,400	4	57,000	2
Insufficient area	55,800	2	—	—	9,800	3	65,600	2
Opposed to harvesting	51,600	2	12,300	4	17,100	5	81,000	3
Other	679,500	28	107,500	33	99,200	31	886,200	29
Total	2,432,900	100	327,200	100	316,100	100	3,076,200	100

*Fewer than 50 owners.
**Less than 0.5 percent.
[a] Includes joint ownerships.
[b] Includes partnerships, undivided estates, clubs, associations, etc.

Table 21.—Who selected the timber to be harvested

Who selected timber	Owners who harvested		Acreage owned	
	No.	*Pct.*	*Acres*	*Pct.*
Landowner	10,600	46	408,400	29
Forester	2,300	10	258,100	19
Friend	800	3	38,400	3
Buyer	4,800	21	325,900	24
Landowner and forester	2,200	10	140,800	10
Landowner and buyer	1,700	7	136,100	10
Other[a]	700	3	70,600	5
Total	23,100	100	1,378,300	100

[a] Includes landowner and friend, forester and friend, forester and buyer, and friend and buyer.

Table 22.—Method of selecting timber to be harvested

Who selected timber	Owners who harvested		Acreage owned	
	No.	*Pct.*	*Acres*	*Pct.*
Selection	6,300	27	466,500	34
Diameter-limit	4,600	20	390,100	28
Clearcutting	5,600	24	170,100	12
Other[a]	5,200	23	283,200	21
Don't know	1,400	6	68,400	5
Total	23,100	100	1,378,300	100

[a] Includes (1) diameter limit-selections, (2) diameter limit-clearcut, and (3) all other methods.

Table 23.—Timber products harvested

Harvesting method[a]	Sawlogs	Veneer logs	Pulpwood	Other products[c]	Total	
			OWNERS			
	No.	*No.*	*No.*	*No.*	*No.*	*No.*
Selection	5,800	400	500	2,800	9,500	34
Diameter limit	4,300	100	400	1,400	6,200	22
Clearcutting	1,300	(*)	1,100	1,700	4,100	15
Other[b]	3,000	(*)	400	3,200	6,600	24
Don't know	600	—	(*)	700	1,300	5
Total	15,000	500	2,400	9,800	27,700	100
			ACREAGE OWNED			
	Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Pct.*
Selection	348,600	18,800	42,800	172,300	582,500	33
Diameter limit	337,900	21,300	24,700	97,200	481,100	28
Clearcutting	118,900	3,400	23,300	79,600	225,200	13
Other[b]	197,400	12,000	19,700	162,300	391,400	22
Don't know	34,300	—	1,800	28,100	64,200	4
Total	1,037,100	55,500	112,300	539,500	1,744,400	100

[a] Owners and acres are counted more than once if multiple products were harvested.

[b] Includes combinations of methods.

[c] Includes fuelwood, posts, poles, etc.

*Fewer than 50 owners.

Table 24.—Expected time of future timber harvest

Expected time of future harvest	Owners		Commercial forest land owned	
	No.	*Pct.*	*Acres*	*Pct.*
	OWNERS WHO HAVE PREVIOUSLY HARVESTED TIMBER			
0 to 10 years	5,500	3	540,900	12
Indefinite	11,500	6	630,200	14
Will never harvest	6,100	4	207,200	5
Total	23,100	13	1,378,300	31
	OWNERS WHO HAVE NOT PREVIOUSLY HARVESTED TIMBER			
0 to 10 years	11,500	6	263,100	6
Indefinite	28,000	15	1,123,100	25
Will never harvest	121,500	66	1,690,000	38
Total	161,000	87	3,076,200	69
	ALL OWNERS			
0 to 10 years	17,000	9	804,000	18
Indefinite	39,500	21	1,753,300	39
Will never harvest	127,600	70	1,897,200	43
Total	184,100	100	4,454,500	100

Tables 25.—Agency from which owners would seek forestry assistance

Agency	Owners		Commercial forest land owned	
	No.	*Pct.*	*Acres*	*Pct.*
County	7,800	4	429,900	10
State	33,100	18	1,248,600	28
Soil Conservation Service	2,800	1	106,000	2
U.S. Forest Service	5,500	3	98,000	2
Consulting forester	5,100	3	217,400	5
Cooperative Extension Service	12,200	7	250,800	6
Other	1,600	1	107,300	2
Don't know	116,000	63	1,996,500	45
Total	184,100	100	4,454,500	100

Table 26.—Forestry services received by owners

Service received	Owners		Commercial forest land owned	
	No.	*Pct.*	*Acres*	*Pct.*
Timber-marking	1,700	1	159,600	4
Timber-stand improvement	5,100	3	268,600	6
Tree-planting	5,900	3	240,500	5
Timber-sales administration	300	(*)	29,000	1
Insect and disease control	1,600	1	31,500	1
Timber-stand evaluation	1,500	1	162,000	4
Surveying	900	(*)	47,000	1
General forest management	2,900	2	252,800	6
Other	1,900	1	151,100	3
Total	21,800	12	1,342,100	30

[a] 19,968 owners (11 percent) owning 1,114,900 acres (25 percent) performed some kind of forestry treatment. Totals do not add to these totals because some performed more than one treatment.

Table 27.—Recreational use of commercial forest land

Use	Owners		Commercial forest land owned	
	No.	*Pct.*	*Acres*	*Pct.*
Hiking	76,800	42	2,144,100	48
Picnicking	41,300	22	1,460,400	33
Camping	32,800	18	1,166,700	26
Fishing	31,800	17	1,355,200	30
Hunting[a]	46,900	25	1,661,700	37

[a] 1,382,300 acres are posted against hunting.

Kingsley, Neal P.
1976. **The forest-land owners of Southern New England.**
Northeast. For. Exp. Stn., Upper Darby, Pa.
27 p., illus. (USDA For. Serv. Resour. Bull. NE-41).

A statistical-analytical report of a mail canvass of the owners of privately owned commercial forest land in the three Southern New England States—Connecticut, Massachusetts, and Rhode Island. The study was conducted in conjunction with the second forest survey of Southern New England by the USDA Forest Service. Trends in forest-land ownership and the attitudes and intentions of owners regarding reasons for owning forest land, timber management, timber harvesting, recreational use, etc., are discussed.

923 -- (744)/(746) -- (083.5)

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Headquarters of the Northeastern Forest Experiment Station are in Upper Darby, Pa. Field laboratories and research units are maintained at:

- Amherst, Massachusetts, in cooperation with the University of Massachusetts.
- Beltsville, Maryland.
- Berea, Kentucky, in cooperation with Berea College.
- Burlington, Vermont, in cooperation with the University of Vermont.
- Delaware, Ohio.
- Durham, New Hampshire, in cooperation with the University of New Hampshire.
- Hamden, Connecticut, in cooperation with Yale University.
- Kingston, Pennsylvania.
- Morgantown, West Virginia, in cooperation with West Virginia University, Morgantown.
- Orono, Maine, in cooperation with the University of Maine, Orono.
- Parsons, West Virginia.
- Pennington, New Jersey.
- Princeton, West Virginia.
- Syracuse, New York, in cooperation with the State University of New York College of Environmental Sciences and Forestry at Syracuse University, Syracuse.
- Warren, Pennsylvania.

OFFICIAL BUSINESS
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ERRATA

"Pulpwood production in the Northeast, 1973", by James T. Bones and David R. Dickson: USDA Forest Service Resource Bulletin NE-37, 1974.

Some errors were found in our report of pulpwood production in the Northeast in 1973. For the benefit of readers who use these statistics for planning purposes, we are sending you, attached, corrected tables to replace those in which the errors occurred.

Table 1.—Total production of pulpwood in the Northeast, by source and state, 1973

[In thousands of rough cords][a]

State	Source		
	From round-wood	From plant residues	From all sources
Connecticut	9.0	1.8	10.8
Delaware	40.0	1.0	41.0
Kentucky	206.3	231.9	438.2
Maine	3,140.7	314.5	3,455.2
Maryland	175.6	101.5	277.1
Massachusetts	18.7	26.9	45.6
New Hampshire	230.7	105.2	335.9
New Jersey	23.5	7.4	30.9
New York	467.9	159.6	627.5
Ohio	222.8	146.5	369.3
Pennsylvania	709.3	243.1	952.4
Rhode Island	5.7	1.7	7.4
Vermont	140.4	52.9	193.3
West Virginia	258.2	158.9	417.1
All states	5,648.8	1,552.9	7,201.7

[a] 128 cubic feet of wood, bark, and air space.

Table 10.—Pulpwood production from roundwood in Kentucky and Ohio, by state and county and species group, 1973

[In thousands of rough cords]

County[a]	Softwood				Hardwood				All species
	Spruce and fir	Hemlock and tamarack	Pine	Total	Aspen and yellow-poplar	Oak and hickory	Other hard-woods	Total	
KENTUCKY									
Ballard	—	—	—	—	1.7	3.9	2.9	8.5	8.5
Bath	—	—	2.8	2.8	2.2	6.9	1.9	11.0	13.8
Boyd	—	—	—	—	(*)	.1	.1	.2	.2
Breathitt	—	—	.1	.1	.1	.2	.1	.4	.5
Breckinridge	—	—	—	—	—	3.0	1.4	4.4	4.4
Butler	—	—	—	—	—	.1	.1	.2	.2
Calloway	—	—	—	—	.1	.1	1.3	1.5	1.5
Carlisle	—	—	—	—	.2	.6	.4	1.2	1.2
Carter	—	—	2.9	2.9	1.9	8.8	3.5	14.2	17.1
Casey	—	—	—	—	—	2.1	1.0	3.1	3.1
Clay	—	—	—	—	—	.2	(*)	.2	.2
Clinton	—	—	—	—	—	2.8	.1	2.9	2.9
Daviess	—	—	—	—	—	3.6	1.7	5.3	5.3
Elliott	—	—	.1	.1	(*)	(*)	(*)	(*)	.1
Fleming	—	—	.1	.1	(*)	(*)	(*)	(*)	.1
Fulton	—	—	—	—	.2	.3	.4	.9	.9
Graves	—	—	—	—	.5	1.1	1.1	2.7	2.7
Grayson	—	—	—	—	—	1.8	.8	2.6	2.6
Greenup	—	—	3.6	3.6	1.8	6.3	1.8	9.9	13.5
Hancock	—	—	—	—	—	4.2	1.9	6.1	6.1
Hardin	—	—	—	—	—	1.0	.5	1.5	1.5
Henderson	—	—	—	—	—	2.9	1.3	4.2	4.2
Hickman	—	—	—	—	.2	.6	.6	1.4	1.4
Jackson	—	—	(*)	(*)	(*)	(*)	(*)	(*)	(*)
Laurel	—	—	4.9	4.9	(*)	2.6	1.0	3.6	8.5
Lawrence	—	—	.6	.6	.4	1.2	.3	1.9	2.5
Lee	—	—	.6	.6	.3	1.1	.3	1.7	2.3
Lewis	—	—	2.1	2.1	4.8	17.9	5.8	28.5	30.6
Livingston	—	—	—	—	—	—	.1	.1	.1
McCracken	—	—	—	—	.2	.6	.4	1.2	1.2
McCreary	—	—	3.3	3.3	—	1.8	1.7	3.5	6.8
Marshall	—	—	—	—	—	—	.1	.1	.1
Meade	—	—	—	—	—	.3	.1	.4	.4
Menifee	—	—	3.6	3.6	1.1	3.5	.9	5.5	9.1
Montgomery	—	—	.2	.2	.2	.5	.1	.8	1.0
Morgan	—	—	2.1	2.1	.3	.8	.2	1.3	3.4
Nelson	—	—	—	—	—	.2	.1	.3	.3
Ohio	—	—	—	—	—	14.5	6.7	21.2	21.2
Owsley	—	—	.2	.2	.1	.2	(*)	.3	.5
Powell	—	—	(*)	(*)	(*)	(*)	(*)	(*)	(*)
Pulaski	—	—	.3	.3	—	—	.4	.4	.7
Rowan	—	—	1.0	1.0	1.4	9.0	2.0	12.4	13.4
Union	—	—	—	—	—	.1	(*)	.1	.1
Wayne	—	—	.6	.6	—	—	—	—	.6
Whitley	—	—	4.8	4.8	—	3.6	3.0	6.6	11.4
Wolfe	—	—	.1	.1	(*)	—	(*)	(*)	.1
Total	—	—	34.0	34.0	17.7	108.5	46.1	172.3	206.3

CONTINUED

Table 10.—Continued

County[a]	Softwood				Hardwood				All species
	Spruce and fir	Hemlock and tamarack	Pine	Total	Aspen and yellow-poplar	Oak and hickory	Other hard-woods	Total	
					OHIO				
Adams	—	—	—	—	0.3	7.0	0.9	8.2	8.2
Ashland	—	—	—	—	—	1.2	.7	1.9	1.9
Athens	—	—	0.3	0.3	1.1	2.0	1.2	4.3	4.6
Belmont	—	—	—	—	—	(*)	—	(*)	(*)
Brown	—	—	—	—	.1	.4	.3	.8	.8
Butler	—	—	—	—	—	.2	.2	.4	.4
Carroll	—	—	—	—	—	.7	—	.7	.7
Clark	—	—	—	—	.1	.3	.2	.6	.6
Clermont	—	—	—	—	—	.1	.1	.2	.2
Clinton	—	—	—	—	.1	.7	.7	1.5	1.5
Coshocton	—	—	—	—	—	14.9	—	14.9	14.9
Delaware	—	—	—	—	—	(*)	—	(*)	(*)
Erie	—	—	—	—	—	.4	.4	.8	.8
Fairfield	—	—	—	—	.1	.1	.1	.3	.3
Gallia	—	0.1	3.5	3.6	.6	5.2	1.3	7.1	10.7
Greene	—	—	—	—	.1	.2	.2	.5	.5
Guernsey	—	—	—	—	—	9.7	—	9.7	9.7
Hamilton	—	—	—	—	—	.1	.1	.2	.2
Harrison	—	—	—	—	—	.6	—	.6	.6
Highland	—	—	—	—	.1	3.5	2.5	6.1	6.1
Hocking	—	—	—	—	2.2	4.4	2.6	9.2	9.2
Holmes	—	—	—	—	—	2.0	—	2.0	2.0
Huron	—	—	—	—	—	.4	.4	.8	.8
Jackson	—	—	.4	.4	2.1	12.8	6.6	21.5	21.9
Knox	—	—	—	—	.1	4.1	.1	4.3	4.3
Lawrence	—	—	(*)	(*)	1.5	7.0	4.4	12.9	12.9
Licking	—	—	—	—	.1	6.4	.2	6.7	6.7
Lorain	—	—	—	—	—	.2	.2	.4	.4
Lucas	—	—	—	—	.1	—	.1	.2	.2
Meigs	—	—	.1	.1	.1	.2	.1	.4	.5
Monroe	—	—	—	—	—	(*)	—	(*)	(*)
Montgomery	—	—	—	—	—	.2	.3	.5	.5
Morrow	—	—	—	—	—	.1	—	.1	.1
Muskingum	—	—	.2	.2	—	8.9	—	8.9	9.1
Noble	—	—	—	—	—	.3	—	.3	.3
Perry	—	—	—	—	.4	3.1	.5	4.0	4.0
Pickaway	—	—	—	—	.9	1.6	1.0	3.5	3.5
Pike	—	—	.1	.1	2.1	12.9	5.6	20.6	20.7
Preble	—	—	—	—	—	(*)	(*)	(*)	(*)
Richland	—	—	—	—	—	(*)	—	(*)	(*)
Ross	—	—	—	—	2.0	8.7	2.9	13.6	13.6
Scioto	—	—	.1	.1	2.2	12.9	4.1	19.2	19.3
Seneca	—	—	—	—	—	.2	.2	.4	.4
Shelby	—	—	—	—	.1	.1	.1	.3	.3
Stark	—	—	—	—	—	.4	—	.4	.4
Tuscarawas	—	—	—	—	—	2.2	—	2.2	2.2
Vinton	—	—	—	—	4.3	15.3	6.2	25.8	25.8
Warren	—	—	—	—	—	.3	.3	.6	.6
Washington	—	—	—	—	—	(*)	—	(*)	(*)
Wayne	—	—	—	—	.1	.2	.1	.4	.4
Wyandot	—	—	—	—	—	(*)	—	(*)	(*)
Total	—	0.1	4.7	4.8	20.9	152.2	44.9	218.0	222.8

* Less than 50 cords.

[a] Counties with no production are omitted.

Table 13.—Pulpwood production from roundwood in New York and New Jersey by country and species group, 1973

[In thousands of rough cords]

County[a]	Softwood				Hardwood				All species
	Spruce and fir	Hemlock and tamarack	Pine	Total	Aspen and yellow-poplar	Oak and hickory	Other hard-woods	Total	
NEW YORK									
Allegany	—	(*)	(*)	(*)	—	—	—	—	(*)
Broome	—	—	—	—	—	—	3.7	3.7	3.7
Cattaraugus	—	0.3	1.0	1.3	1.6	—	2.2	3.8	5.1
Chemung	—	—	—	—	.5	0.2	.6	1.3	1.3
Chenango	3.8	—	(*)	3.8	.6	1.0	3.1	4.7	8.5
Clinton	3.7	.3	2.2	6.2	2.3	—	39.4	41.7	47.9
Columbia	—	—	(*)	(*)	—	—	—	—	(*)
Cortland	1.9	—	1.0	2.9	(*)	(*)	(*)	(*)	2.9
Delaware	(*)	—	—	(*)	.1	.2	3.1	3.4	3.4
Essex	1.4	3.8	5.3	10.5	3.3	—	43.1	46.4	56.9
Franklin	26.6	.1	2.3	29.0	1.8	—	22.6	24.4	53.4
Fulton	(*)	3.7	1.0	4.7	.2	—	13.2	13.4	18.1
Genesee	—	—	—	—	.2	—	(*)	.2	.2
Greene	—	—	(*)	(*)	—	—	(*)	(*)	(*)
Hamilton	3.4	1.9	.9	6.2	1.0	—	28.0	29.0	35.2
Herkimer	4.4	(*)	.3	4.7	—	—	3.7	3.7	8.4
Jefferson	(*)	—	2.0	2.0	1.8	—	.8	2.6	4.6
Lewis	4.0	—	1.9	5.9	3.3	—	24.7	28.0	33.9
Madison	1.6	—	—	1.6	(*)	—	—	(*)	1.6
Oneida	.7	—	1.1	1.8	.1	—	7.1	7.2	9.0
Onondaga	—	—	—	—	(*)	—	—	(*)	(*)
Oswego	(*)	—	.9	.9	(*)	—	.5	.5	1.4
Otsego	3.0	—	4.0	7.0	.1	—	.4	.5	7.5
Rensselaer	.2	(*)	1.7	1.9	.6	—	1.9	2.5	4.4
St. Lawrence	14.1	1.8	5.1	21.0	4.4	—	31.8	36.2	57.2
Saratoga	1.1	5.6	11.1	17.8	1.9	—	23.6	25.5	43.3
Schoharie	.7	—	1.2	1.9	—	—	(*)	(*)	1.9
Schuyler	—	—	—	—	.3	—	—	.3	.3
Sullivan	—	—	—	—	—	—	.1	.1	.1
Tioga	—	—	—	—	.3	.4	1.0	1.7	1.7
Tompkins	—	—	—	—	.1	.4	.8	1.3	1.3
Warren	2.9	5.5	3.3	11.7	2.2	—	23.0	25.2	36.9
Washington	.1	1.9	2.5	4.5	1.3	—	12.0	13.3	17.8
Total	73.6	24.9	48.8	147.3	28.0	2.2	290.4	320.6	467.9
NEW JERSEY									
Atlantic	—	—	6.2	6.2	—	—	0.5	0.5	6.7
Burlington	—	—	12.2	12.2	—	—	.4	.4	12.6
Camden	—	—	2.8	2.8	—	(*)	—	—	2.8
Cumberland	—	—	.7	.7	—	—	.1	.1	.8
Ocean	—	—	.6	.6	—	—	—	1.0	1.6
Total	—	—	22.5	22.5	—	(*)	1.0	1.0	23.5

* Less than 50 cords.

[a] Counties with no production are omitted.

Table 14.—Pulpwood production from roundwood in Pennsylvania, by county and species group, 1973

[In thousands of rough cords]

County[a]	Softwood				Hardwood				All species
	Spruce and fir	Hemlock and tamarack	Pine	Total	Aspen and yellow-poplar	Oak and hickory	Other hard-woods	Total	
Adams	—	—	0.4	0.4	—	3.5	1.8	5.3	5.7
Armstrong	—	(*)	.1	.1	(*)	(*)	.4	.4	.5
Bedford	—	0.7	5.4	6.1	6.2	13.4	7.2	26.8	32.9
Berks	—	—	.1	.1	—	.2	.1	.3	.4
Blair	—	.1	.3	.4	1.0	4.2	7.8	13.0	13.4
Bradford	—	—	—	—	5.5	8.0	15.6	29.1	29.1
Bucks	—	—	—	—	—	.3	.2	.5	.5
Butler	—	—	—	—	—	—	1.1	1.1	1.1
Cambria	—	.2	.8	1.0	.1	1.6	6.5	8.2	9.2
Cameron	—	—	—	—	—	(*)	13.0	13.0	13.0
Carbon	—	—	—	—	—	(*)	—	(*)	(*)
Centre	0.1	.3	.8	1.2	2.5	15.7	17.7	35.9	37.1
Clarion	—	—	—	—	—	(*)	1.1	1.1	1.1
Clearfield	(*)	.9	1.9	2.8	3.0	16.6	43.6	63.2	66.0
Clinton	—	.1	.3	.4	2.0	12.0	41.1	55.1	55.5
Columbia	—	—	(*)	(*)	.2	.8	1.1	2.1	2.1
Crawford	—	—	—	—	—	—	4.3	4.3	4.3
Cumberland	—	—	.9	.9	—	4.5	1.9	6.4	7.3
Dauphin	—	—	(*)	(*)	.2	.6	1.1	1.9	1.9
Elk	—	—	—	—	—	5.4	36.3	41.7	41.7
Erie	—	—	—	—	—	—	3.8	3.8	3.8
Fayette	—	(*)	(*)	(*)	.5	.9	.3	1.7	1.7
Forest	—	—	—	—	—	(*)	8.9	8.9	8.9
Franklin	—	—	1.2	1.2	—	7.2	3.6	10.8	12.0
Fulton	—	(*)	2.4	2.4	(*)	4.5	3.4	7.9	10.3
Greene	—	—	—	—	—	(*)	—	(*)	(*)
Huntingdon	—	.5	5.4	5.9	2.0	10.9	14.7	27.6	33.5
Indiana	—	.1	2.2	2.3	.1	.1	.7	.9	3.2
Jefferson	—	(*)	.1	.1	.2	.4	2.3	2.9	3.0
Juniata	—	(*)	.7	.7	—	1.7	.7	2.4	3.1
Lackawanna	—	—	—	—	1.0	2.4	4.8	8.2	8.2
Lancaster	—	—	(*)	(*)	—	.3	.1	.4	.4
Lawrence	—	—	(*)	(*)	—	—	—	—	(*)
Lebanon	—	—	(*)	(*)	—	(*)	—	(*)	(*)
Luzerne	—	—	.1	.1	.8	2.5	4.3	7.6	7.7
Lycoming	—	(*)	.3	.3	3.3	12.6	17.7	33.6	33.9
McKean	—	—	—	—	3.7	—	28.4	32.1	32.1
Mercer	—	—	—	—	—	—	.5	.5	.5
Mifflin	—	(*)	.1	.1	(*)	(*)	(*)	(*)	.1
Monroe	—	—	—	—	.1	.3	.4	.8	.8
Montour	—	—	.1	.1	—	.4	.2	.6	.7
Northumberland	—	—	(*)	(*)	—	.7	.2	.9	.9
Perry	—	(*)	.6	.6	.2	2.7	1.1	4.0	4.6
Pike	—	—	—	—	.1	.2	.3	.6	.6
Potter	—	—	—	—	(*)	.4	14.2	14.6	14.6
Schuylkill	—	—	.4	.4	.3	3.3	2.4	5.9	6.3
Snyder	—	—	.4	.4	(*)	.6	.4	1.0	1.4
Somerset	—	.1	1.1	1.2	3.5	6.2	6.8	16.5	17.7
Sullivan	—	—	—	—	4.0	3.0	13.0	20.0	20.0
Susquehanna	—	—	—	—	3.8	10.3	20.5	34.6	34.6
Tioga	—	—	—	—	1.7	2.6	3.8	8.1	8.1
Union	—	—	.1	.1	—	1.4	.3	1.7	1.8
Venango	—	(*)	.1	.1	—	—	40.1	40.1	40.2
Warren	—	—	—	—	4.6	—	40.7	45.3	45.3
Wayne	—	—	—	—	1.1	2.9	10.4	14.4	14.4
Wyoming	—	—	—	—	.8	1.8	3.8	6.4	6.4
York	—	—	1.7	1.7	—	2.7	1.3	4.0	5.7
Total	0.1	3.0	28.0	31.1	52.4	169.8	456.0	678.2	709.3

* Less than 50 cords.

[a] Counties with no production are omitted.

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PULPWOOD PRODUCTION in the Northeast—1974

by James T. Bones and David R. Dickson

USDA FOREST SERVICE RESOURCE BULLETIN NE-42
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NORTHEASTERN FOREST EXPERIMENT STATION
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COVER PHOTO. Mountains of wood chips—like this one in Ohio—are required each year to satisfy the wood requirements of northeastern pulpmills. Twenty-three percent of the pulpwood production in the Northeast in 1974 was from chipped manufacturing residues. The 1.8 million cord equivalent produced in 1974 was a 13-percent increase over 1973 and a record high for the region. (Cover photo credit: *Ohio Department of Natural Resources, Division of Forestry*.)

Background

THIS ANNUAL REPORT is based on a canvass of all pulpmills in the Northeast that use wood—either roundwood or plant residues—as a basic raw material for a variety of products. Cross-boundary shipments were traced by exchanging information with neighboring experiment stations that conduct similar canvasses. Mills that use pulpwood as a raw material in producing insulation board and hardboard were also included in the canvass.

The statistics for production from roundwood reported in this bulletin are based upon mill receipts, which are subject to fluctuations caused by uneven wood-inventory buildups or liquidations from year to year. The plant residues are received at the pulpmill mostly in chip form. Origins of mill receipts of pulpwood from roundwood are reported by county where harvested. However, pulpwood from plant residues can be traced only to the state where they were produced. Some of the logs from which the residue came were probably harvested in states other than the one in which they were processed.

1974 in Retrospect

In 1974, pulpwood production was geared down in response to diminishing demand for paper products. Pulp and paper producers entered the year operating at peak levels. Woodyard inventories were adequate, since the winter was less severe than normal, and certain northeastern pulpmills had supplemented wood supplies with "brown chips" from total-tree harvesters. Several northeastern pulp and paper manufacturers announced plans to re-invest record 1973 profits in expansion of their existing pulping facilities early in 1974; while other integrated manufacturers, previously closed for environmental reasons, indicated plans for re-opening their papermaking facilities and purchasing pulp on the open market.

Then, during the second half of 1974, the sagging economy caught up with the paper industry. Demand for paperboard dried up. Kraft pulp production began to catch up with the backlog of new orders, and pulpmills adjusted their work schedules downward. By year's end, the woodyard inventory at northeastern pulpmills had grown to more than a million cords, up from 600,000 cords in 1973.

Although pulpwood suppliers were restricted in their deliveries, they were not cut off. One reason for this temporary delay in curtailing round pulpwood deliveries was because woodchip deliveries from plant residues were down. Chipped residues normally make up more than 20 percent of the wood receipts at northeastern pulpmills.

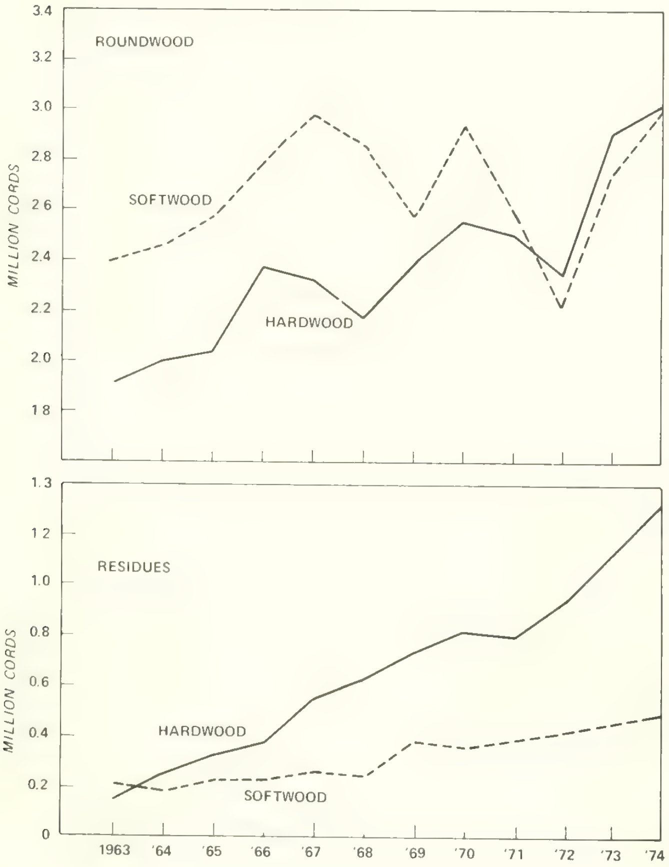
Although most paper-industry analysts agree that a worldwide pulp and paper shortage is imminent, they are reluctant to predict when the pulp-and-paper economy will return to normal. Meanwhile, pulpmills are upgrading the quality of the pulpwood they will accept from suppliers, and some suppliers who have recently obligated large sums of money for sophisticated harvesting equipment find themselves short of working capital because of decreased sales. One bright spot on the horizon in the Northeast is the announcement by a major multination corporation of their intentions to establish a 600-ton-per-day bleached hardwood kraft pulpmill in the upper Connecticut River Valley. Of course completion of this project is several years away.

Pulpwood Production Continues Upward Trend

The 7,751,800 cords of pulpwood produced in the 14 northeastern states (Connecticut, Delaware, Kentucky, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, and West Virginia) in 1974 represented an increase of 8 percent over the 7,201,700 cords reported in 1973, and a 67-percent increase over the harvest that was reported during the Station's first annual canvass in 1963. During the last 11 years, pulpwood production in the Northeast has grown at a 6-percent average annual rate.

This year's increase was due to rises in production of both softwood and hardwood roundwood and production of hardwood chips from plant residues (fig. 1). Softwood chip production remained at the same level as in 1973. Woodyard inventories have been building, and receipts at some woodyards have been curtailed as pulpmills reduce production schedules in response to slackened demand for paper products.

Figure 1.—Pulpwood production for all states, by years and sources of wood.



Roundwood pulpwood production from hardwoods was greater than that of softwoods and accounted for 51 percent of the total harvest in 1974. Total production of chips from plant residues increased 205,000 cord equivalents over 1973 production. Hardwoods accounted for 56 percent of all pulpwood produced in 1974, down about 0.1 of a percentage point from 1973.

Receipts of pulpwood at woodpulp mills in the Northeast totaled 8,477,200 cords in 1974. These receipts included wood harvested in the Northeast and pulpwood imported from other regions. Hardwood receipts exceeded those of softwoods by 688,400 cords. Total receipts exceeded total production by 725,400 cords (table 2).

Five of the 14 states (Connecticut, Delaware, Massachusetts, Vermont, and West Virginia) produced more wood than they received. Delaware, Massachusetts, and West Virginia had no operating woodpulp mills. Vermont and Connecticut each had one. Pulpwood receipts of 15 percent or more over 1973 levels were registered in Kentucky (up 16 percent), New York (up 17 percent), and Vermont (up 29 percent). Connecticut, New Hampshire, and Rhode Island reported a decline in receipts between years.

In previous years, a major portion of the northeastern requirement for pulpwood was satisfied by shipments of softwood Canadian pulpwood into the Northeast. This trend has been changing as more southern pulpwood has been finding its way into northern woodyards and as pulpmills continue to use larger quantities of hardwood. In 1974, about 47 percent of the roundwood shipments into the Northeast came from Canada, and 46 percent came from the Southern States. The remaining 7 percent came from the Lake States and Central States. Although softwood roundwood imports exceeded hardwood imports, reversing last year's trend, hardwood chip imports exceeded softwood imports by more than 2 to 1.

Production from Roundwood Up 6 Percent

The production of pulpwood from roundwood increased 345,100 cords—a 6-percent increase over 1973. The 5,993,900 cords of roundwood produced in 1974 represents the highest production level attained since the annual production surveys were begun in the Northeast in 1963.

The 1974 pulpwood production from roundwood was up from 1973 in 8 of the 14 states. Connecticut, Kentucky, Massachusetts, Pennsylvania, Rhode Island, and West Virginia registered production decreases. Production increases of 20 percent or more were recorded in New Jersey, New York, and Vermont. Maine, which accounts for 56 percent of the roundwood that is harvested in the Northeast, registered an 8-percent gain in production between 1973 and 1974.

Twenty Counties Top 50-Thousand-Cord Mark

Twenty counties in six states produced more than 50,000 cords of pulpwood from roundwood in 1974. This is an increase of three counties over the 1973 level, and it equals the previous record that was set in 1967. The 3.9 million cords of roundwood harvested from these counties represents 66 percent of the total roundwood harvest in the Northeast.

Stepped-up harvesting in New York was responsible for five counties to be included in the list of high-production counties. New Hampshire, Vermont, Pennsylvania, and West Virginia each had single representatives. As in previous years, Maine counties dominated the list of 20 counties. Counties that produced more than 50,000 cords of pulpwood from roundwood in 1974, and their production totals, are:

County	*Production (thousand cords)*
Aroostook, Maine	678.6
Piscataquis, Maine	557.2
Sommerset, Maine	512.5
Washington, Maine	436.1
Penobscot, Maine	397.6
Oxford, Maine	227.9
Coos, New Hampshire	202.1
Franklin, Maine	151.9
Hancock, Maine	85.3
Essex, Vermont	82.1
Essex, New York	80.0
Clearfield, Pennsylvania	66.5
Franklin, New York	65.9
St. Lawrence, New York	62.1
Kennebec, Maine	60.6
Waldo, Maine	59.3
Hamilton, New York	53.9
Greenbrier, West Virginia	53.1
Clinton, New York	53.0
Androscoggin, Maine	50.4

Roundwood Harvest as Related to Growing-Stock Inventory

Although figures 3, 4, and 5 show the total roundwood harvest by production class and county in the Northeast, these figures do not relate the volume harvested to the volume of growing-stock trees that are actually present. Growing-stock volume is net volume in cubic feet of sound live trees of commercial species that are 5.0 inches dbh or larger, from a 1-foot stump to a minimum 4.0-inch top diameter outside bark of the central bole, or to the point where the bole breaks into limbs. The growing-stock volumes by species group and states that are used for making this comparison are based on those compiled for the 1970 National Timber Review.

The following tabulation of harvesting intensity shows the volume of growing stock present per unit harvested—by state and species group—in thousand cubic feet of growing stock present for each cord of pulpwood harvested in 1974:

SOFTWOOD	
Maryland	5.1
Delaware	5.8
Maine	6.4
—	—
Average	9.4
New Jersey	10.2
West Virginia	12.9
Vermont	15.7
New York	19.4
Rhode Island	22.1
Kentucky	25.1
Ohio	30.2
New Hampshire	45.6
Pennsylvania	48.9
Connecticut	55.6
Massachusetts	84.6

HARDWOOD	
Maine	6.0
New Hampshire	11.9
Ohio	16.0
New York	22.8
Average	23.8
Vermont	26.4
Pennsylvania	28.0
Maryland	34.6
Delaware	67.9
Kentucky	70.4
Rhode Island	77.1
West Virginia	82.5
New Jersey	479.9
Connecticut	556.8
Massachusetts	671.3
—	—

The states have been ranked (top to bottom) from the state in which the roundwood harvest was most intensive to the state in which the harvest was least intensive. These rankings and the regional averages should not be viewed as an index or standard for harvesting, but simply as a means of directing individuals engaged in pulpwood procurement from several alternative areas toward the most promising one.

For each cord of pulpwood harvested in the Northeast in 1974, there were 9,400 cubic feet of softwood growing stock and 23,800 cubic feet of hardwood growing stock. The softwood harvest was more intensive than the regional average in Maryland, Delaware, and Maine. The hardwood harvest was more intensive than the regional average in Maine, New Hampshire, Ohio, and New York. Harvesting intensity was relatively low in the urbanizing states and in those states that had no pulpmills or that had a single mill operating.

Total-Tree Harvesting

Total-tree chipping has caught on in portions of the Northeast because of the favorable economics of this new harvesting system. With the cost of skilled labor and raw material (wood) going up, total-tree harvesters are an attractive alternative to conventional harvesting equipment if the brown chips that result (unbarked bolewood and topwood) are acceptable to the pulpmill. At present most users of total-tree chips in the Northeast produce kraft pulp from hardwoods. Therefore, much of the present activity centers around the central Appalachian hardwood region in Ohio, Pennsylvania, and West Virginia, and to a lesser extent in New Hampshire and Maine.

The following tabulation presents some of the information we were able to assemble about total-tree chipping activities in the Northeast in 1974:

	Harvesters operating in 1974 (No.)	*Total-tree chip production (thousand cords)*	*Percent of total harvest (percent)*
Maine	8	99.4	3
New Hampshire	4	23.1	9
New Jersey	1	.1	([a])
New York	1	5.0	1
Ohio	13	74.4	28
Pennsylvania	7	26.8	4
West Virginia	3	7.3	3

[a] Less than 0.5 percent.

Wood Chip Production Increases 13 Percent

The production of wood chips and sawdust from plant residues for use as woodpulp increased 13 percent over the 1,552,900 cord equivalents produced in 1973. In the first half of the year, high primary wood-manufacturing rates that generated large quantities of coarse plant residues accounted for the increased residue production. A marked slowdown in wood manufacture during the last half of 1974 restricted the amount of residue material that was available. Those pulpmills that had not curtailed production because of high paper inventories supplemented their wood supplies with roundwood rather than residues.

Pulpwood chip production by states in 1973 and 1974 are compared in the following tabulation:

	1973 (thousand cord equivalents)	*1974 (thousand cord equivalents)*	*Change (percent)*
Connecticut	1.8	2.4	+33
Delaware	1.0	—	([a])
Kentucky	231.9	263.3	+14
Maine	314.5	336.6	+ 7
Maryland	101.5	107.9	+ 6
Massachusetts	26.9	18.8	−30
New Hampshire	105.2	139.1	+32
New Jersey	7.4	6.2	−16
New York	159.6	200.0	+25
Ohio	146.5	115.6	−21
Pennsylvania	243.1	308.8	+27
Rhode Island	1.7	(*)	([a])
Vermont	52.9	60.7	+15
West Virginia	158.9	198.5	+25
Total	1,552.9	1,757.9	+13

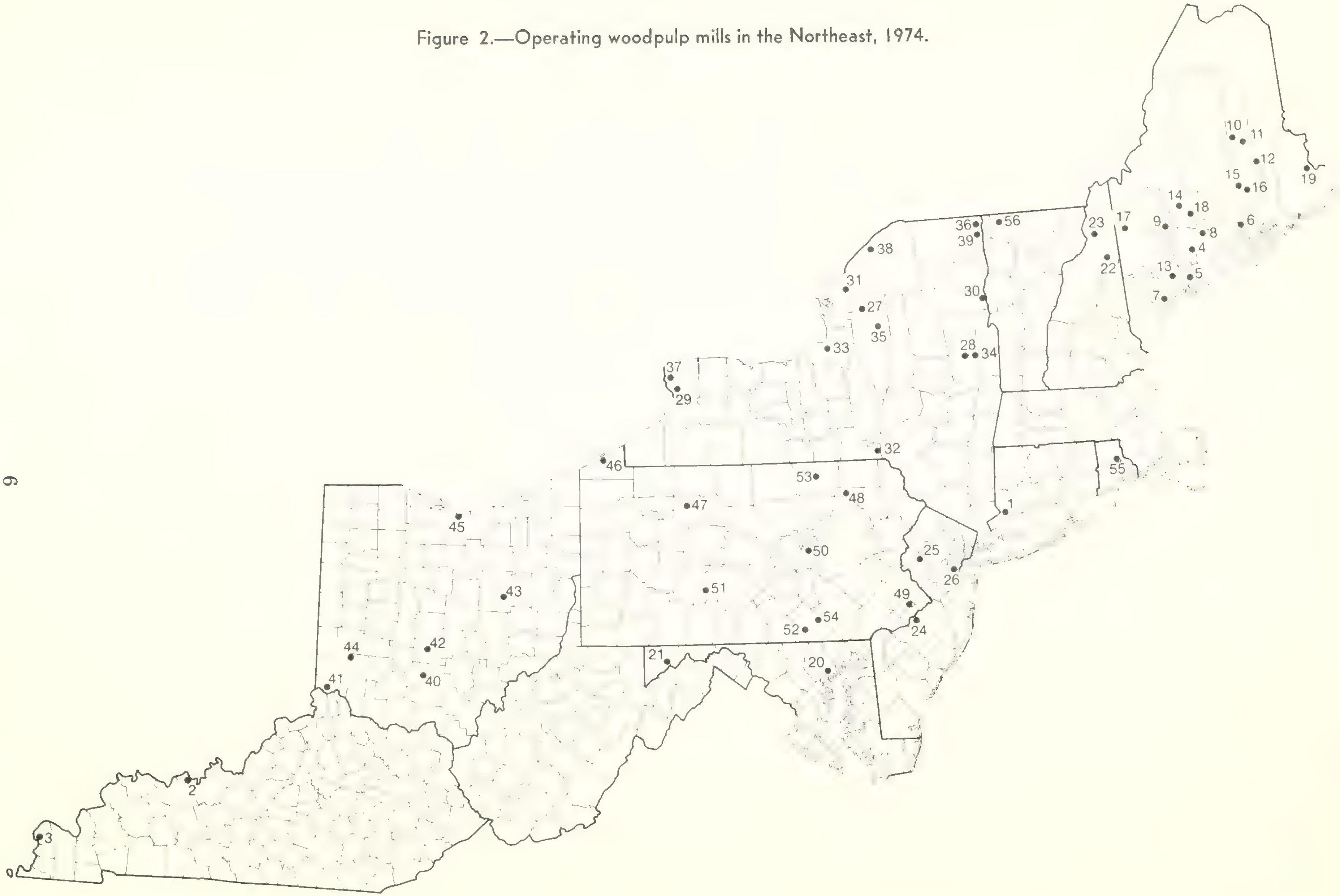
(*) Less than 50 cord equivalents.

[a] Little or no production in 1974.

Chip production was up in nine states. Connecticut, New Hampshire, New York, Pennsylvania, and West Virginia showed gains of 25 percent or more in chip production between 1973 and 1974. The highest absolute volume gain (65,700 cord equivalents) was made by Pennsylvania. The 1974 production of chips and sawdust from plant residues accounted for 23 percent of the northeastern pulpwood production total, up nearly 2 percentage points from 1973.

Hardwood chip production from plant residues rose 15 percent, while softwood chip production climbed 10 percent. Chip production for both hardwoods and softwoods in 1974 stands at all-time record levels.

Figure 2.—Operating woodpulp mills in the Northeast, 1974.



OPERATING WOODPULP MILLS IN THE NORTHEAST, 1974

Number	Mill Name and Location	Capacity (tons/24 hrs.)
	CONNECTICUT	
1	Tilo Company, Strafford	35
	KENTUCKY	
*2	Wescor and Western Kraft, Hawesville	550
3	Westvaco, Wickliffe	600
	MAINE	
*4	Statler Tissue Co., Augusta	270
5	Pejepscot Paper Co., Brunswick	115
6	St. Regis Paper Co., Bucksport	320
7	Scott Paper Co., Cumberland Falls	300
8	Scott Paper Co., Winslow	490
*9	International Paper Co., Jay	775
10	Great Northern Nekoosa Corp., Millinocket	1,375
11	Great Northern Nekoosa Corp., E. Millinocket	920
12	Permoid Corp., Lincoln	280
13	U.S. Gypsum, Lisbon Falls	100
14	Kennebec River Pulp Co., Madison	135
15	Lily Tulip Corp., Old Town	50
*16	Diamond International Corp., Old Town	750
*17	Oxford Paper Co., Rumford	670
18	Keyes Fibre Co., Shawnut	105
19	Georgia Pacific Corp., Woodland	1,037
	MARYLAND	
20	Congoleum Industries, Finksburg	45
21	Westvaco, Luke	789
	NEW HAMPSHIRE	
*22	Brown Co., Berlin	975
23	Diamond International Corp., Groveton	250
	NEW JERSEY	
24	GAF Corp., Gloucester City	192
25	Johns-Manville Products Corp., Manville	100
26	Celotex Corp., Perth Amboy	100
	NEW YORK	
27	Latex Fiber Industries, Beaver Falls	70
28	International Paper Co., Corinth	255
29	International Paper Co., No. Tonawanda	140
30	International Paper Co., Ticonderoga	500
31	St. Regis Paper Co., Deferiet	240
32	Celotex Corp., Deposit	300
33	Armstrong Cork Co., Fulton	130
34	Finch Pruyn Co., Glen Falls	350
35	Georgia Pacific Corp., Lyons Falls	120
36	Georgia Pacific Corp., Plattsburgh	100
37	Nitec Paper Corp., Niagara Falls	100
38	Diamond International Corp., Ogdensburg	110
39	Diamond International Corp., Plattesburgh	50
	OHIO	
40	Mead Corp., Chillicothe	600
41	Celotex Corp., Cincinnati	100
42	Container Corp. of America, Circleville	300
43	Stone Container Corp., Coshocton	650
44	Logan-Long Co., Franklin	80
45	Certain-Teed Products Corp., Milan	90
	PENNSYLVANIA	
46	Hammermill Paper Co., Erie	700
47	Pentech Papers Inc., Johnsonburg	170
48	Charmin Paper Products Co., Mehoopany	Unknown
49	Celotex Corp., Philadelphia	160
50	Celotex Corp., Sunbury	240
51	Appleton Papers, Inc., Roaring Springs	180
52	P. H. Glatfelter Co., Spring Grove	525
53	Masonite Corp., Towanda	280
54	Certain-Teed Products Corp., York	80
	RHODE ISLAND	
55	Bird and Son, Inc., Phillipdale	275
	VERMONT	
56	Saxon Industries, Sheldon Springs	50

* More than one pulpmill operating.

Tabular Data

Table 1.—Total production of pulpwood in the Northeast, by source and state, 1974. (In thousands of rough cords.)

Table 2.—Total production and receipts of pulpwood in the Northeast, by state and species group, 1974. (In thousands of rough cords.)

Table 3.—Pulpwood production from roundwood in the Northeast, by state and species group, 1974. (In thousands of rough cords.)

Table 4.—Pulpwood chip production from plant residues in the Northeast, by state and species group, 1974. (In thousands of rough cord equivalents.)

Table 5.—Pulpwood receipts from roundwood in the Northeast, by state and species group, 1974. (In thousands of rough cords.)

Table 6.—Pulpwood chip receipts from plant residues in the Northeast by state and species group, 1974. (In thousands of rough cord equivalents.)

Table 7.—Pulpwood from roundwood received from states outside the Northeast, by state (or province) of origin and species group, 1974. (In thousands of rough cords.)

Table 8.—Pulpwood chip receipts from wood-using plants outside the Northeast, by state (or province) of origin and species group, 1974. (In thousands of rough cord equivalents.)

Table 9.—Pulpwood production from roundwood in the Northeast, by state and species group, 1974. (In thousands of rough cords.)

Table 10.—Pulpwood production from roundwood in Kentucky and Ohio, by state and county and species group, 1974. (In thousands of rough cords.)

Table 11.—Pulpwood production from roundwood in Southern New England, by state and county and species group, 1974. (In thousands of rough cords.)

Table 12.—Pulpwood production from roundwood in Northern New England, by state and county, and species group, 1974. (In thousands of rough cords.)

Table 13.—Pulpwood production from roundwood in New York, by county and species group, 1974. (In thousands of rough cords.)

Table 14.—Pulpwood production from roundwood in Pennsylvania, by county and species group, 1974. (In thousands of rough cords.)

Table 15.—Pulpwood production from roundwood in Delaware, Maryland, and New Jersey, by state and county and species group, 1974. (In thousands of rough cords.)

Table 16.—Pulpwood production from roundwood in West Virginia, by county and species group, 1974. (In thousands of rough cords.)

Table 1.—Total production of pulpwood in the Northeast, by source and state, 1974

[In thousands of rough cords][a]

State	Source		
	From roundwood	From plant residues	From all sources
Connecticut	7.1	2.4	9.5
Delaware	46.1	—	46.1
Kentucky	133.1	263.3	396.4
Maine	3,384.4	336.6	3,721.0
Maryland	177.5	107.9	285.4
Massachusetts	12.0	18.8	30.8
New Hampshire	251.1	139.1	390.2
New Jersey	40.7	6.2	46.9
New York	574.2	200.0	774.2
Ohio	261.2	115.6	376.8
Pennsylvania	699.8	308.8	1,008.6
Rhode Island	4.1	(*)	4.1
Vermont	197.8	60.7	258.5
West Virginia	213.6	198.5	412.1
All states	6,002.7	1,757.9	7,760.6

[a] 128 cubic feet of wood, bark, and air space.

* Less than 50 cord equivalents.

Table 2.—Total production and receipts of pulpwood in the Northeast, by state and species group, 1974

[In thousands of rough cords]

State	Total production		Total receipts		Production surplus (+) or deficit (−)
	Softwood	Hardwood	Softwood	Hardwood	
Connecticut	5.0	4.5	(D)	(D)	+ (D)
Delaware	39.8	6.3	—	—	+ 46.1
Kentucky	33.7	362.7	123.9	559.9	−287.4
Maine	2,562.9	1,158.1	2,909.6	1,189.5	−378.1
Maryland	155.5	129.9	155.7	314.9	−185.2
Massachusetts	13.4	17.4	—	—	+ 30.8
New Hampshire	164.2	226.0	89.8	412.6	−112.2
New Jersey	41.2	5.7	54.6	17.1	− 24.8
New York	194.7	579.5	301.5	553.0	− 80.3
Ohio	7.3	369.5	9.0	532.5	−164.7
Pennsylvania	48.5	960.1	196.6	991.7	−179.7
Rhode Island	.9	3.2	(D)	(D)	− (D)
Vermont	130.6	127.9	(D)	(D)	+ (D)
West Virginia	54.5	357.6	—	—	+412.1
All states	3,452.2	4,308.4	3,881.0	4,581.7	−702.1

(D) Data withheld to avoid disclosure for individual mills.

Table 3.—Pulpwood production from roundwood in the Northeast, by state and species group, 1974

[In thousands of rough cords]

State	Softwood				Hardwood				Total production
	Cut and retained in state	Shipped to other states		Total softwood	Cut and retained in state	Shipped to other states		Total hardwood	
		In Northeast	Outside Northeast			In Northeast	Outside Northeast		
Connecticut	2.8	1.3	—	4.1	—	3.0	—	3.0	7.1
Delaware	—	19.7	20.1	39.8	—	5.8	0.5	6.3	46.1
Kentucky	—	(*)	24.8	24.8	42.2	39.2	26.9	108.3	133.1
Maine	2,298.6	7.6	1.5	2,307.7	1,010.7	66.0	—	1,076.7	3,384.4
Maryland	24.0	30.2	49.8	104.0	64.6	8.0	.9	73.5	177.5
Massachusetts	—	9.1	—	9.1	—	2.9	—	2.9	12.0
New Hampshire	23.3	39.3	—	62.6	166.0	22.5	—	188.5	251.1
New Jersey	37.9	—	—	37.9	2.8	(*)	—	2.8	40.7
New York	164.4	5.0	—	169.4	327.7	26.1	51.0	404.8	574.2
Ohio	—	4.1	—	4.1	255.6	1.5	—	257.1	261.2
Pennsylvania	20.6	12.1	—	32.7	603.5	63.6	—	667.1	699.8
Rhode Island	.9	—	—	.9	3.2	—	—	3.2	4.1
Vermont	19.4	64.6	23.1	107.1	—	90.7	—	90.7	197.8
West Virginia	—	43.9	6.9	50.8	—	90.5	72.3	162.8	213.6
All states	2,591.9	236.9	126.2	2,955.0	2,476.3	419.8	151.6	3,047.7	6,002.7

* Less than 50 cords.

Table 4.—Pulpwood chip production from plant residues in the Northeast, by state and species group, 1974

[In thousands of rough cord equivalents]

State	Softwood				Hardwood				Total production
	Produced and retained in state	Shipped to other states		Total softwood	Produced and retained in state	Shipped to other states		Total hardwood	
		In Northeast	Outside Northeast			In Northeast	Outside Northeast		
Connecticut	—	0.9	—	0.9	—	1.5	—	1.5	2.4
Delaware	—	—	—	—	—	—	—	—	—
Kentucky	—	6.4	2.5	8.9	172.4	36.2	45.8	254.4	263.3
Maine	254.4	.8	(*)	255.2	65.0	16.4	—	81.4	336.6
Maryland	1.4	36.6	13.5	51.5	13.4	43.0	—	56.4	107.9
Massachusetts	—	4.3	—	4.3	—	14.5	—	14.5	18.8
New Hampshire	45.1	55.7	.8	101.6	20.1	17.2	.2	37.5	139.1
New Jersey	1.6	1.7	—	3.3	1.4	1.5	—	2.9	6.2
New York	16.6	8.7	—	25.3	97.2	27.9	49.6	174.7	200.0
Ohio	—	3.2	—	3.2	108.7	3.7	—	112.4	115.6
Pennsylvania	13.0	2.8	—	15.8	242.8	50.2	—	293.0	308.8
Rhode Island	—	—	—	—	—	(*)	—	(*)	(*)
Vermont	—	21.5	2.0	23.5	—	37.2	—	37.2	60.7
West Virginia	—	1.4	2.3	3.7	—	93.4	101.4	194.8	198.5
All states	332.1	144.0	21.1	497.2	721.0	342.7	197.0	1,260.7	1,757.9

Table 5.—Pulpwood receipts from roundwood in the Northeast, by state and species group, 1974

[In thousands of rough cords]

State[a]	Softwood				Hardwood				Total receipts
	Cut and retained in state	Receipts from other states		Total softwood	Cut and retained in state	Receipts from other states		Total hardwood	
		In Northeast	Outside Northeast			In Northeast	Outside Northeast		
Connecticut	2.8	(D)	(D)	(D)	—	(D)	(D)	(D)	(D)
Kentucky	—	—	94.6	94.6	42.2	—	154.0	196.2	290.8
Maine	2,298.6	16.1	227.0	2,541.7	1,010.7	21.2	83.4	1,115.3	3,657.0
Maryland	24.0	55.2	68.2	147.4	64.6	135.0	18.4	218.0	365.4
New Hampshire	23.3	14.3	.6	38.2	166.0	135.5	50.2	351.7	389.9
New Jersey	37.9	—	—	37.9	2.8	—	—	2.8	40.7
New York	164.4	80.5	9.1	254.0	327.7	29.6	9.5	366.8	620.8
Ohio	—	—	—	—	255.6	49.5	10.1	315.2	315.2
Pennsylvania	20.6	59.6	55.9	136.1	603.5	42.1	20.8	666.4	802.5
Rhode Island	.9	(D)	(D)	(D)	3.2	(D)	(D)	(D)	(D)
Vermont	19.4	(D)	(D)	(D)	—	(D)	(D)	(D)	(D)
All states	2,591.9	236.6	457.2	3,285.7	2,476.3	420.0	346.4	3,242.7	6,528.4

[a] States with no pulpmills are omitted.
(D) Data withheld to avoid disclosure for individual mills.

Table 6.—Pulpwood chip receipts from plant residues in the Northeast, by state and species group, 1974[a]

[In thousands of rough cord equivalents]

State[b]	Softwood				Hardwood				Total receipts
	Produced and retained in state	Receipts from other states		Total softwood	Produced and retained in state	Receipts from other states		Total hardwood	
		In Northeast	Outside Northeast			In Northeast	Outside Northeast		
Connecticut	—	(D)	(D)	(D)	—	(D)	(D)	(D)	(D)
Kentucky	—	—	29.3	29.3	172.4	—	191.3	363.7	393.0
Maine	254.4	41.8	71.7	367.9	65.0	8.8	.4	74.2	442.1
Maryland	1.4	4.2	2.7	8.3	13.4	76.8	6.7	96.9	105.2
New Hampshire	45.1	5.2	1.3	51.6	20.1	24.4	16.4	60.9	112.5
New Jersey	1.6	10.3	4.8	16.7	1.4	12.9	—	14.3	31.0
New York	16.6	30.9	—	47.5	97.2	57.2	31.8	186.2	233.7
Ohio	—	7.3	1.7	9.0	108.7	97.5	11.1	217.3	226.3
Pennsylvania	13.0	39.8	7.7	60.5	242.8	65.1	17.4	325.3	385.8
Rhode Island	—	(D)	(D)	(D)	—	(D)	(D)	(D)	(D)
Vermont	—	(D)	(D)	(D)	—	(D)	(D)	(D)	(D)
All states	332.1	144.0	119.2	595.3	721.0	342.9	275.1	1,339.0	1,934.3

[a] Includes sawmill slabs and edgings, veneer cores, and post and pole trimmings.
[b] States with no pulpmills are omitted.
(D) Data withheld to avoid disclosure for individual mills.

Table 7.—Pulpwood from roundwood received from states outside the Northeast, by state or province of origin and species group, 1974

[In thousands or rough cords]

Receiving state[a]	State or province of origin	Total softwood	Total hardwood	All species
Kentucky	Illinois	1.7	9.8	11.5
	Indiana	—	17.2	17.2
	Mississippi	82.6	103.0	185.6
	Missouri	.2	10.4	10.6
	Tennessee	10.1	13.6	23.7
Maine	New Brunswick	219.5	66.8	286.3
	Quebec	7.5	16.6	24.1
Maryland	Virginia	68.2	18.4	86.6
New Hampshire	Quebec	.6	50.2	50.8
New York	Ontario	2.1	9.5	11.6
	Quebec	7.0	(*)	7.0
Ohio	Alabama	—	.4	.4
	Indiana	—	5.3	5.3
	Michigan	—	4.4	4.4
Pennsylvania	Virginia	55.9	20.8	76.7
Vermont	Quebec	1.8	—	1.8
All states	—	457.2	346.4	803.6

[a] States with no receipts are omitted.

* Less than 50 cords.

Table 8.—Pulpwood chip receipts from wood-using plants outside the Northeast, by state or province of origin and species group, 1974

[In thousands of rough cord equivalents]

Receiving state[a]	State or province of origin	Total softwood	Total hardwood	All species
Kentucky	Alabama	—	2.6	2.6
	Arkansas	—	3.0	3.0
	Illinois	—	24.8	24.8
	Indiana	—	40.2	40.2
	Mississippi	26.2	25.4	51.6
	Missouri	3.1	48.3	51.4
	Tennessee	—	47.0	47.0
Maine	Quebec	71.7	.4	72.1
Maryland	Virginia	2.7	6.7	9.4
New Hampshire	Quebec	1.3	16.4	17.7
New Jersey	Virginia	4.8	—	4.8
New York	Ontario	—	24.2	24.2
	Quebec	—	7.6	7.6
Ohio	Indiana	—	2.0	2.0
	Michigan	—	.1	.1
	Tennessee	—	4.1	4.1
	Virginia	1.7	4.9	6.6
Pennsylvania	Virginia	7.7	17.4	25.1
All states	—	119.2	275.1	394.3

[a] States with no receipts are omitted.

Table 9.—Pulpwood production from roundwood in the Northeast, by state and species group, 1974

[In thousands of rough cords]

State	Softwood				Hardwood				All species
	Spruce and fir	Hemlock and tamarack	Pine	Total	Aspen and yellow-poplar	Oak and hickory	Other hard-woods	Total	
Connecticut	—	—	4.1	4.1	—	1.4	1.6	3.0	7.1
Delaware	—	—	39.8	39.8	—	4.1	2.2	6.3	46.1
Kentucky	—	0.1	24.7	24.8	14.4	65.8	28.1	108.3	133.1
Maine	1,890.5	257.8	159.4	2,307.7	143.6	34.5	898.6	1,076.7	3,384.4
Maryland	.9	1.8	101.3	104.0	6.4	50.8	16.3	73.5	177.5
Massachusetts	—	—	9.1	9.1	.1	1.2	1.6	2.9	12.0
New Hampshire	46.7	4.4	11.5	62.6	43.3	1.4	143.8	188.5	251.1
New Jersey	—	—	37.9	37.9	—	—	2.8	2.8	40.7
New York	78.0	19.7	71.7	169.4	29.0	9.1	366.7	404.8	574.2
Ohio	.1	.2	3.8	4.1	28.3	92.9	135.9	257.1	261.2
Pennsylvania	.6	3.4	28.7	32.7	57.2	261.4	348.5	667.1	699.8
Rhode Island	—	—	.9	.9	—	1.5	1.7	3.2	4.1
Vermont	95.4	3.1	8.6	107.1	30.7	1.1	58.9	90.7	197.8
West Virginia	7.8	4.9	38.1	50.8	27.7	97.2	37.9	162.8	213.6
All states	2,120.0	295.4	539.6	2,955.0	380.7	622.4	2,044.6	3,047.7	6,002.7

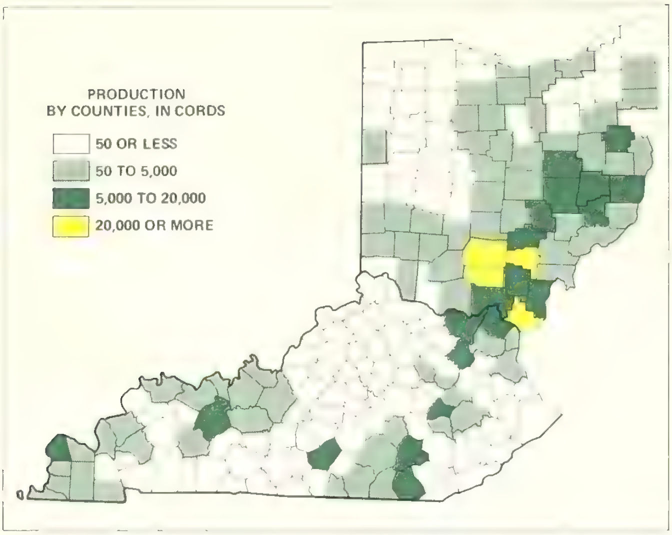


Figure 3.—Geographical pattern of pulpwood pr duction from roundwood in Kentucky and Ohio b counties and species groups, 1974.

Table 10.—Pulpwood production from roundwood in Kentucky and Ohio, by states and counties and species groups, 1974

[In thousands of rough cords]

County[a]	Softwood				Hardwood				All species
	Spruce and fir	Hemlock and tamarack	Pine	Total	Aspen and yellow-poplar	Oak and hickory	Other hard-woods	Total	
				KENTUCKY					
Adair	—	(*)	2.1	2.1	0.8	1.8	0.5	3.1	5.2
Ballard	—	—	—	—	1.5	3.4	2.6	7.5	7.5
Boyd	—	—	—	—	.1	.4	.6	1.1	1.1
Breathitt	—	(*)	.2	.2	.1	.3	.1	.5	.7
Breckenridge	—	—	—	—	—	1.2	.6	1.8	1.8
Bullitt	—	—	—	—	—	(*)	(*)	(*)	(*)
Caldwell	—	—	—	—	.1	.2	.1	.4	.4
Calloway	—	—	—	—	.1	.2	.3	.6	.6
Carlisle	—	—	—	—	.4	.8	.7	1.9	1.9
Carter	—	(*)	.2	.2	.4	1.2	.5	2.1	2.3
Clinton	—	—	—	—	—	2.4	.6	3.0	3.0
Crittenden	—	—	—	—	.1	.2	.1	.4	.4
Daviess	—	—	—	—	—	2.3	.1	2.4	2.4
Elliott	—	—	(*)	(*)	—	—	—	—	(*)
Estill	—	—	(*)	(*)	(*)	(*)	(*)	(*)	(*)
Fleming	—	(*)	(*)	(*)	(*)	(*)	—	(*)	(*)
Floyd	—	—	(*)	(*)	—	—	—	—	(*)
Fulton	—	—	—	—	.2	.5	.4	1.1	1.1
Graves	—	—	—	—	.6	1.4	1.2	3.2	3.2
Grayson	—	—	—	—	—	1.7	.8	2.5	2.5
Greenup	—	(*)	.1	.1	2.1	8.3	2.6	13.0	13.1
Hancock	—	—	—	—	—	2.6	1.2	3.8	3.8
Hardin	—	—	—	—	—	.2	.1	.3	.3
Henderson	—	—	—	—	—	.8	.4	1.2	1.2
Hickman	—	—	—	—	.3	.7	.5	1.5	1.5
Jackson	—	(*)	.8	.8	.1	.1	.1	.3	1.1
Laurel	—	—	4.3	4.3	(*)	.8	.4	1.2	5.5
Lawrence	—	(*)	.2	.2	.2	.6	.2	1.0	1.2
Lee	—	0.1	2.5	2.6	.9	1.9	.5	3.3	5.9
Lewis	—	(*)	.4	.4	3.6	9.7	3.6	16.9	17.3
Livingston	—	—	—	—	.1	.2	.1	.4	.4
McCracken	—	—	—	—	.4	.9	.6	1.9	1.9
McCreary	—	—	3.8	3.8	—	.2	.5	.7	4.5
Meads	—	—	—	—	—	.1	(*)	.1	.1
Menifee	—	(*)	1.1	1.1	.2	.4	.1	.7	1.8
Montgomery	—	(*)	.2	.2	(*)	.1	(*)	.1	.3
Muhlenberg	—	—	—	—	—	2.2	1.0	3.2	3.2
Nelson	—	—	—	—	—	(*)	(*)	(*)	(*)
Ohio	—	—	—	—	—	5.9	2.6	8.5	8.5
Owsley	—	(*)	.7	.7	.3	.6	.2	1.1	1.8
Powell	—	—	(*)	(*)	—	—	—	—	(*)
Pulaski	—	—	.3	.3	—	—	—	—	.3

CONTINUED

Table 10.—Continued

County[a]	Softwood				Hardwood				All species
	Spruce and fir	Hemlock and tamarack	Pine	Total	Aspen and yellow-poplar	Oak and hickory	Other hard-woods	Total	
Rowan	—	(*)	.1	.1	1.7	7.9	1.7	11.3	11.4
Wayne	—	(*)	1.0	1.0	.1	.9	.3	1.3	2.3
Whitley	—	—	6.6	6.6	—	2.7	2.2	4.9	11.5
Wolfe	—	(*)	.1	.1	—	—	—	—	.1
Total	—	0.1	24.7	24.8	14.4	65.8	28.1	108.3	133.1
OHIO									
Adams	—	—	—	—	0.3	3.8	0.5	4.6	4.6
Ashland	—	—	—	—	—	(*)	.4	.4	.4
Athens	—	—	(*)	(*)	.7	1.3	.8	2.8	2.8
Belmont	—	—	—	—	—	—	15.0	15.0	15.0
Brown	—	—	(*)	(*)	—	—	—	—	(*)
Butler	—	—	—	—	—	—	.3	.3	.3
Carroll	—	—	—	—	—	—	12.0	12.0	12.0
Champaign	—	—	—	—	(*)	(*)	(*)	(*)	(*)
Clark	—	—	—	—	(*)	(*)	(*)	(*)	(*)
Clermont	—	—	—	—	—	—	.1	.1	.1
Clinton	—	—	—	—	.1	.8	.7	1.6	1.6
Coshocton	—	—	—	—	(*)	.2	8.1	8.3	8.3
Crawford	—	—	—	—	(*)	.1	.1	.2	.2
Cuyahoga	—	—	—	—	.3	.7	1.7	2.7	2.7
Delaware	—	—	—	—	—	—	.4	.4	.4
Erie	—	—	—	—	—	.3	.1	.4	.4
Fairfield	—	—	—	—	.6	1.0	1.0	2.6	2.6
Fayette	—	—	—	—	(*)	.1	(*)	.1	.1
Franklin	—	—	—	—	.1	.2	.2	.5	.5
Gallia	0.1	0.1	1.5	1.7	.7	4.0	1.2	5.9	7.6
Greene	—	—	—	—	—	—	.4	.4	.4
Guernsey	(*)	—	—	(*)	—	—	7.7	7.7	7.7
Harrison	—	—	—	—	—	—	3.0	3.0	3.0
Highland	—	—	—	—	.5	.8	1.4	2.7	2.7
Hocking	—	—	—	—	3.3	5.5	3.5	12.3	12.3
Holmes	—	—	—	—	—	—	1.5	1.5	1.5
Huron	—	—	—	—	(*)	.3	.2	.5	.5
Jackson	(*)	(*)	.1	.1	2.4	9.0	4.9	16.3	16.4
Jefferson	—	—	—	—	(*)	.1	(*)	.1	.1
Knox	—	—	—	—	(*)	(*)	2.0	2.0	2.0
Lawrence	—	—	—	—	3.3	10.4	6.9	20.6	20.6
Licking	—	—	—	—	—	—	1.5	1.5	1.5
Lorain	—	—	—	—	—	.1	.1	.2	.2
Mahoning	(*)	(*)	.9	.9	—	—	—	—	.9
Marion	—	—	—	—	—	.1	(*)	.1	.1
Meigs	(*)	.1	.8	.9	.1	.4	.2	.7	1.6
Mercer	—	—	—	—	.1	.2	.2	.5	.5
Monroe	—	—	—	—	—	—	2.6	2.6	2.6
Montgomery	—	—	—	—	—	—	.3	.3	.3
Morgan	—	—	—	—	.1	.1	4.3	4.5	4.5
Morrow	—	—	—	—	—	—	.2	.2	.2
Muskingham	—	—	—	—	—	—	11.6	11.6	11.6
Noble	—	—	—	—	—	—	5.0	5.0	5.0
Perry	—	—	—	—	.2	.3	4.5	5.0	5.0
Pickaway	—	—	—	—	1.0	1.7	1.1	3.8	3.8
Pike	(*)	(*)	.1	.1	3.3	14.9	7.5	25.7	25.8
Preble	—	—	—	—	(*)	(*)	.2	.2	.2
Ross	—	—	—	—	3.9	15.1	5.0	24.0	24.0
Scioto	—	—	—	—	2.1	8.5	3.0	13.6	13.6
Seneca	—	—	—	—	—	.2	(*)	.2	.2
Shelby	—	—	—	—	(*)	(*)	(*)	(*)	(*)
Stark	—	—	—	—	—	—	4.2	4.2	4.2
Trumbull	—	—	.4	.4	—	—	—	—	.4
Tuscarawas	—	—	—	—	—	—	3.1	3.1	3.1
Vinton	—	—	—	—	4.5	10.9	5.1	20.5	20.5
Warren	—	—	—	—	—	—	.3	.3	.3
Washington	—	—	—	—	.7	1.7	1.8	4.2	4.2
Wyandot	—	—	—	—	(*)	.1	(*)	.1	.1
Total	0.1	0.2	3.8	4.1	28.3	92.9	135.9	257.1	261.2

[a] Counties with no production are omitted.
* Less than 50 cords.

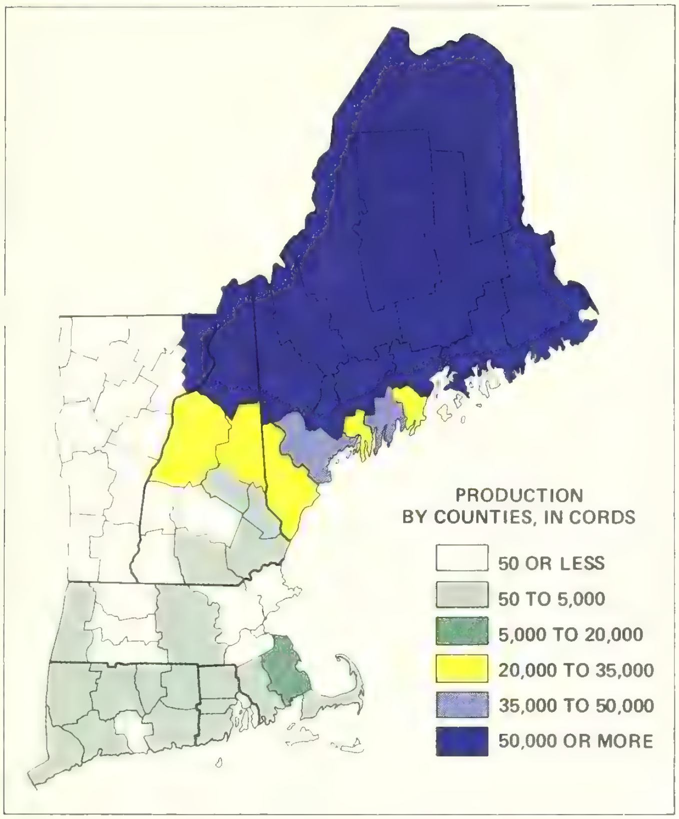


Figure 4.—Geographical pattern of pulpwood production from roundwood in the New England States, 1974.

Table 11.—Pulpwood production from roundwood in Southern New England, by states and counties and species, 1974

[In thousands of rough cords]

County[a]	Softwood				Hardwood				All species
	Spruce and fir	Hemlock and tamarack	Pine	Total	Aspen and yellow-poplar	Oak and hickory	Other hard-woods	Total	
CONNECTICUT									
Fairfield	—	—	0.8	0.8	—	—	—	—	0.8
Hartford	—	—	1.2	1.2	—	—	—	—	1.2
Litchfield	—	—	.1	.1	—	—	—	—	.1
New Haven	—	—	.8	.8	—	—	—	—	.8
New London	—	—	.2	.2	—	0.2	0.3	0.5	.7
Tolland	—	—	.1	.1	—	.1	.1	.2	.3
Windham	—	—	.9	.9	—	1.1	1.2	2.3	3.2
Total	—	—	4.1	4.1	—	1.4	1.6	3.0	7.1
MASSACHUSETTS									
Barnstable	—	—	0.7	0.7	—	—	—	—	0.7
Berkshire	—	—	—	—	0.1	—	0.2	0.3	.3
Bristol	—	—	1.6	1.6	—	0.5	.6	1.1	2.7
Plymouth	—	—	6.2	6.2	—	.7	.8	1.5	7.7
Worcester	—	—	.6	.6	—	—	—	—	.6
Total	—	—	9.1	9.1	0.1	1.2	1.6	2.9	12.0
RHODE ISLAND									
Kent	—	—	0.2	0.2	—	0.8	0.9	1.7	1.9
Providence	—	—	.5	.5	—	.4	.5	.9	1.4
Washington	—	—	.2	.2	—	.3	.3	.6	.8
Total	—	—	0.9	0.9	—	1.5	1.7	3.2	4.1

[a] Counties with no production are omitted.

Table 12.—Pulpwood production from roundwood in Northern New England, by states and counties and species groups, 1974

[In thousands of rough cords]

County[a]	Softwood				Hardwood				All species
	Spruce and fir	Hemlock and tamarack	Pine	Total	Aspen and yellow-poplar	Oak and hickory	Other hardwoods	Total	
				MAINE					
Androscoggin	6.8	8.5	11.7	27.0	1.7	0.8	20.9	23.4	50.4
Aroostook	509.3	32.6	2.8	544.7	40.1	3.5	90.3	133.9	678.6
Cumberland	3.5	2.9	18.1	24.5	.9	.7	18.5	20.1	44.6
Franklin	34.6	6.0	5.5	46.1	14.4	3.4	88.0	105.8	151.9
Hancock	48.2	10.9	5.7	64.8	1.1	.7	18.7	20.5	85.3
Kennebec	5.0	8.3	19.4	32.7	3.0	.9	24.0	27.9	60.6
Knox	9.9	4.6	9.0	23.5	.3	.4	10.1	10.8	34.3
Lincoln	5.4	6.0	13.8	25.2	.7	.6	15.9	17.2	42.4
Oxford	46.0	15.3	14.3	75.6	13.0	5.2	134.1	152.3	227.9
Penobscot	173.9	80.1	10.5	264.5	21.7	4.1	107.3	133.1	397.6
Piscataquis	431.1	21.2	2.9	455.2	9.2	3.4	89.4	102.0	557.2
Sagadahoc	3.5	3.6	7.6	14.7	.2	.2	6.8	7.2	21.9
Somerset	371.7	16.3	7.1	395.1	12.8	3.9	100.7	117.4	512.5
Waldo	17.2	6.2	12.2	35.6	3.1	.8	19.8	23.7	59.3
Washington	223.9	34.8	8.0	266.7	21.3	5.5	142.6	169.4	436.1
York	.5	.5	10.8	11.8	.1	.4	11.5	12.0	23.8
Total	1,890.5	257.8	159.4	2,307.7	143.6	34.5	898.6	1,076.7	3,384.4
				NEW HAMPSHIRE					
Belknap	—	—	0.1	0.1	—	—	(*)	—	0.1
Carroll	1.6	1.2	2.2	5.0	0.5	(*)	22.3	22.8	27.8
Coos	42.5	2.9	1.5	46.9	41.8	0.8	112.6	155.2	202.1
Grafton	2.6	.3	7.3	10.2	1.0	.3	8.6	9.9	20.1
Hillsborough	—	—	(*)	(*)	—	.1	.2	.3	.3
Rockingham	—	—	.4	.4	—	.1	.1	.2	.6
Strafford	—	—	(*)	(*)	—	.1	(*)	.1	.1
Total	46.7	4.4	11.5	62.6	43.3	1.4	143.8	188.5	251.1
				VERMONT					
Addison	1.6	(*)	0.3	1.9	0.1	0.1	1.9	2.1	4.0
Bennington	.2	—	.9	1.1	(*)	.2	4.4	4.6	5.7
Caledonia	9.7	0.6	1.0	11.3	1.2	.1	7.6	8.9	20.2
Chittenden	.3	(*)	1.2	1.5	.9	—	—	.9	2.4
Essex	53.8	1.0	(*)	54.8	25.1	.1	24.4	49.6	104.4
Franklin	.5	—	—	.5	.1	(*)	1.4	1.5	2.0
Lamoille	1.1	.2	—	1.3	—	.1	1.3	1.4	2.7
Orange	—	(*)	—	(*)	—	—	—	—	(*)
Orleans	13.4	.9	.5	14.8	1.9	.1	8.4	10.4	25.2
Rutland	3.6	—	2.2	5.8	.4	.1	1.5	2.0	7.8
Washington	1.1	—	.5	1.6	.2	—	—	.2	1.8
Windham	2.9	.2	.8	3.9	.2	.2	6.2	6.6	10.5
Windsor	7.2	.2	1.2	8.6	.6	.1	1.8	2.5	11.1
Total	95.4	3.1	8.6	107.1	30.7	1.1	58.9	90.7	197.8

[a] Counties with no production are omitted.
* Less than 50 cords.

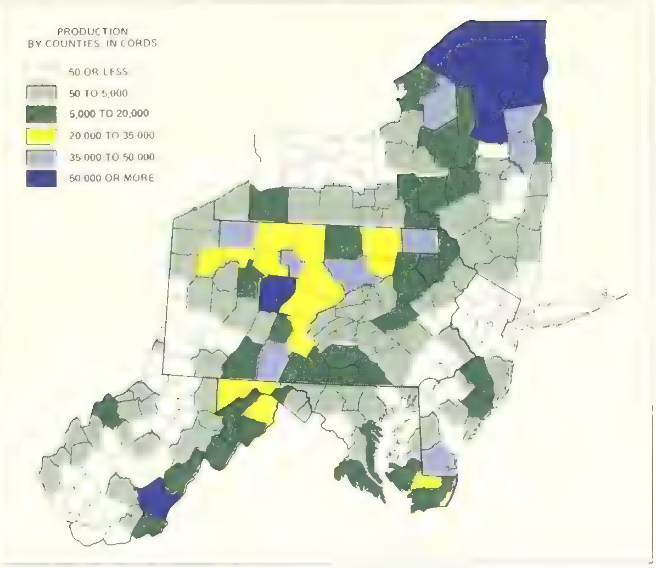


Figure 5.—Geographical pattern of pulpwood production from roundwood in the Middle Atlanti States, 1974.

Table 13.—Pulpwood production from roundwood in New York, by counties and species groups, 1974

[In thousands of rough cords]

County[a]	Softwood				Hardwood				All species
	Spruce and fir	Hemlock and tamarack	Pine	Total	Aspen and yellow-poplar	Oak and hickory	Other hard-woods	Total	
Allegany	—	—	0.1	0.1	—	—	—	—	0.1
Broome	0.3	—	—	.3	0.1	0.5	4.4	5.0	5.3
Cattaraugus	—	—	4.6	4.6	—	2.2	.3	2.5	7.1
Chautauqua	—	—	—	—	.2	—	.3	.5	.5
Chemung	—	—	—	—	.8	.9	1.5	3.2	3.2
Chenango	3.5	—	.1	3.6	.1	.5	2.1	2.7	6.3
Clinton	5.4	0.5	3.8	9.7	2.1	—	41.2	43.3	53.0
Columbia	—	—	—	—	—	—	.1	.1	.1
Cortland	2.8	—	1.2	4.0	.3	1.3	1.6	3.2	7.2
Delaware	—	—	(*)	(*)	.1	.3	4.5	4.9	4.9
Dutchess	—	—	.1	.1	—	—	—	—	.1
Essex	2.1	6.1	11.0	19.2	4.6	—	56.2	60.8	80.0
Franklin	30.8	.2	1.6	32.6	2.5	—	30.8	33.3	65.9
Fulton	(*)	1.3	1.4	2.7	.2	—	19.5	19.7	22.4
Genesee	—	—	—	—	—	—	(*)	(*)	(*)
Hamilton	3.6	2.1	1.6	7.3	2.6	—	44.0	46.6	53.9
Herkimer	5.2	(*)	.6	5.8	(*)	—	10.2	10.2	16.0
Jefferson	.4	—	4.1	4.5	.8	—	1.0	1.8	6.3
Lewis	4.0	.4	6.7	11.1	2.8	—	21.9	24.7	35.8
Madison	.5	—	1.0	1.5	(*)	—	.1	.1	1.6
Montgomery	(*)	—	.3	.3	—	—	—	—	.3
Oneida	1.7	.5	2.9	5.1	.1	—	2.9	3.0	8.1
Onondaga	.1	—	.2	.3	.1	.4	.5	1.0	1.3
Orange	—	—	—	—	(*)	.2	.3	.5	.5
Oswego	(*)	—	.7	.7	.1	—	.3	.4	1.1
Otsego	1.8	—	5.8	7.6	(*)	—	.1	.1	7.7
Rensselaer	.2	—	1.5	1.7	.5	—	1.8	2.3	4.0
St. Lawrence	12.2	1.9	4.9	19.0	4.3	—	38.8	43.1	62.1
Saratoga	2.1	2.4	8.6	13.1	1.7	—	34.2	35.9	49.0
Schenectady	(*)	—	.1	.1	—	—	—	—	.1
Schoharie	.5	—	2.1	2.6	.1	.4	1.2	1.7	4.3
Schuyler	—	—	—	—	.5	.2	.8	1.5	1.5
Steuben	—	—	—	—	.2	.2	.8	1.2	1.2
Sullivan	—	—	—	—	(*)	.2	.5	.7	.7
Tioga	—	—	—	—	.9	1.2	2.0	4.1	4.1
Tompkins	.1	—	—	.1	.1	.6	.8	1.5	1.6
Ulster	—	—	(*)	(*)	—	—	.1	.1	.1
Warren	.6	2.2	4.7	7.5	2.5	—	29.9	32.4	39.9
Washington	.1	2.1	2.0	4.2	.7	—	12.0	12.7	16.9
Total	78.0	19.7	71.7	169.4	29.0	9.1	366.7	404.8	574.2

[a] Counties with no production are omitted.
* Less than 50 cords.

Table 14.—Pulpwood production from roundwood in Pennsylvania, by counties and species groups, 1974

[In thousands of rough cords]

County[a]	Softwood				Hardwood				All species
	Spruce and fir	Hemlock and tamarack	Pine	Total	Aspen and yellow-poplar	Oak and hickory	Other hard-woods	Total	
Adams	—	—	0.4	0.4	—	4.0	2.0	6.0	6.4
Armstrong	—	—	—	—	—	.4	.3	.7	.7
Bedford	0.2	0.7	6.4	7.3	6.0	17.6	14.2	37.8	45.1
Berks	—	—	.1	.1	—	—	—	—	.1
Blair	(*)	(*)	1.0	1.0	1.2	4.0	8.4	13.6	14.6
Bradford	—	—	(*)	(*)	6.4	6.8	16.5	29.7	29.7
Bucks	—	—	—	—	—	.1	.1	.2	.2
Butler	—	—	—	—	—	—	1.3	1.3	1.3
Cambria	—	—	.1	.1	.1	.4	.5	1.0	1.1
Cameron	—	—	—	—	—	29.6	6.4	36.0	36.0
Carbon	—	—	—	—	—	.1	(*)	.1	.1
Centre	(*)	.3	.9	1.2	2.6	12.0	9.8	24.4	25.6
Clarion	—	.1	—	.1	(*)	.5	.6	1.1	1.2
Clearfield	.2	.8	4.3	5.3	3.6	34.3	23.3	61.2	66.5
Clinton	(*)	.2	.6	.8	1.9	11.6	14.5	28.0	28.8
Columbia	—	—	(*)	(*)	.1	.7	.8	1.6	1.6
Crawford	—	—	—	—	—	—	1.3	1.3	1.3
Cumberland	—	—	.7	.7	—	3.2	1.3	4.5	5.2
Dauphin	—	—	.1	.1	.1	.9	.6	1.6	1.7
Delaware	—	—	—	—	—	—	(*)	(*)	(*)
Elk	—	—	—	—	(*)	4.0	21.9	25.9	25.9
Erie	—	—	—	—	—	—	3.4	3.4	3.4
Fayette	(*)	(*)	.2	.2	1.2	2.1	.7	4.0	4.2
Forest	—	—	—	—	—	4.0	17.0	21.0	21.0
Franklin	(*)	(*)	.7	.7	.1	7.6	3.8	11.5	12.2
Fulton	.1	.4	2.3	2.8	.9	4.6	2.6	8.1	10.9
Greene	—	—	—	—	(*)	(*)	(*)	(*)	(*)
Huntingdon	.1	.5	4.1	4.7	1.8	11.8	6.8	20.4	25.1
Indiana	(*)	(*)	.5	.5	.3	1.1	1.1	2.5	3.0
Jefferson	(*)	.1	.2	.3	.1	1.9	5.3	7.3	7.6
Juniata	—	—	.8	.8	(*)	1.7	.8	2.5	3.3
Lackawanna	—	—	—	—	.5	2.3	3.0	5.8	5.8
Lancaster	—	—	—	—	(*)	.4	.2	.6	.6
Lebanon	—	—	(*)	(*)	—	.1	(*)	.1	.1
Luzerne	—	—	.2	.2	.8	5.0	6.8	12.6	12.8
Lycoming	(*)	—	(*)	(*)	3.1	14.3	20.6	38.0	38.0
McKean	—	—	—	—	4.0	.2	26.1	30.3	30.3
Mercer	—	—	—	—	(*)	(*)	.4	.4	.4
Mifflin	(*)	(*)	.3	.3	.2	.5	.5	1.2	1.5
Monroe	—	—	—	—	.1	.5	.6	1.2	1.2
Montgomery	—	—	—	—	—	—	(*)	(*)	(*)
Montour	—	—	(*)	(*)	.1	.6	.4	1.1	1.1
Northumberland	—	—	.1	.1	—	1.0	(*)	1.0	1.1
Perry	—	—	.5	.5	.1	2.0	1.5	3.6	4.1
Pike	—	—	—	—	.1	.4	.7	1.2	1.2
Potter	—	—	—	—	1.6	.6	30.0	32.2	32.2
Schuylkill	—	—	.2	.2	.3	5.1	3.0	8.4	8.6
Snyder	—	—	.4	.4	(*)	1.2	.4	1.6	2.0
Somerset	(*)	.1	.5	.6	3.2	5.4	2.4	11.0	11.6
Sullivan	—	—	—	—	8.7	2.7	14.3	25.7	25.7
Susquehanna	—	—	—	—	3.8	13.5	20.0	37.3	37.3
Tioga	—	—	(*)	(*)	1.4	2.1	5.4	8.9	8.9
Union	—	—	.2	.2	—	3.6	.3	3.9	4.1
Venango	—	.2	—	.2	—	16.1	6.2	22.3	22.5
Warren	—	—	—	—	.9	11.9	29.0	41.8	41.8
Wayne	—	—	—	—	.5	2.6	5.8	8.9	8.9
Westmoreland	—	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)
Wyoming	—	—	—	—	1.4	2.3	4.7	8.4	8.4
York	—	—	2.9	2.9	—	2.0	.9	2.9	5.8
Total	0.6	3.4	28.7	32.7	57.2	261.4	348.5	667.1	699.8

[a] Counties with no production are omitted.
* Less than 50 cords.

Table 15.—Pulpwood production from roundwood in Delaware, Maryland, and New Jersey, by states and counties and species groups, 1974

[In thousands of rough cords]

County[a]	Softwood				Hardwood				All species
	Spruce and fir	Hemlock and tamarack	Pine	Total	Aspen and yellow-poplar	Oak and hickory	Other hard-woods	Total	
				DELAWARE					
Kent	—	—	2.2	2.2	—	0.1	(*)	0.1	2.3
Sussex	—	—	37.6	37.6	—	4.0	2.2	6.2	43.8
Total	—	—	39.8	39.8	—	4.1	2.2	6.3	46.1
				MARYLAND					
Allegany	0.1	0.2	2.1	2.4	2.7	19.2	6.1	28.0	30.4
Anne Arundel	(*)	.1	4.3	4.4	.5	4.8	1.7	6.9	11.3
Baltimore	—	—	1.6	1.6	—	.2	.2	.4	2.0
Clavert	.3	.5	4.8	5.6	(*)	(*)	(*)	(*)	5.6
Caroline	—	—	3.5	3.5	—	.3	.2	.5	4.0
Carroll	—	—	1.5	1.5	—	.3	.2	.5	2.0
Cecil	—	—	—	—	—	.1	(*)	.1	.1
Charles	(*)	(*)	5.2	5.2	—	.7	.3	1.0	6.2
Dorchester	—	—	6.7	6.7	(*)	.3	.1	.4	7.1
Frederick	—	—	.2	.2	—	.4	.2	.6	.8
Garrett	.1	.1	1.3	1.5	3.1	21.8	6.2	31.2	32.7
Harford	—	—	(*)	(*)	(*)	(*)	(*)	(*)	(*)
Howard	(*)	(*)	(*)	(*)	—	.1	(*)	.1	.1
Prince Georges	—	—	.1	.1	—	.1	(*)	.1	.2
St. Marys	.4	.8	7.3	8.5	—	—	—	—	8.5
Somerset	—	—	19.5	19.5	—	—	—	—	19.5
Washington	(*)	.1	.9	1.0	.1	1.7	.7	2.5	3.5
Wicomico	—	—	32.0	32.0	—	.7	.4	1.1	33.1
Worcester	—	—	10.3	10.3	—	.1	(*)	.1	10.4
Total	0.9	1.8	101.3	104.0	6.4	50.8	16.3	73.5	177.5
				NEW JERSEY					
Atlantic	—	—	12.7	12.7	—	—	1.0	1.0	13.7
Burlington	—	—	16.8	16.8	—	—	1.1	1.1	17.9
Camden	—	—	3.7	3.7	—	—	.2	.2	3.9
Cape May	—	—	3.8	3.8	—	—	.2	.2	4.0
Cumberland	—	—	.5	.5	—	—	.2	.2	.7
Gloucester	—	—	—	—	—	—	(*)	(*)	(*)
Ocean	—	—	.4	.4	—	—	.1	.1	.5
Total	—	—	37.9	37.9	—	—	2.8	2.8	40.7

[a] Counties with no production are omitted.
* Less than 50 cords.

Table 16.—Pulpwood production from roundwood in West Virginia, by counties and species groups, 1974

[In thousands of rough cords]

County[a]	Softwood				Hardwood				All species
	Spruce and fir	Hemlock and tamarack	Pine	Total	Aspen and yellow-poplar	Oak and hickory	Other hard-woods	Total	
Berkeley	0.1	(*)	1.5	1.6	0.1	1.8	0.7	2.6	4.2
Braxton	(*)	(*)	(*)	(*)	.1	.1	.1	.3	.3
Cabell	.1	0.1	.4	.6	(*)	.2	(*)	.2	.8
Calhoun	(*)	(*)	.1	.1	(*)	.2	(*)	.2	.3
Doddridge	(*)	(*)	(*)	(*)	(*)	.1	(*)	.1	.1
Fayette	—	(*)	(*)	(*)	(*)	.1	.1	.2	.2
Grant	.6	.3	2.1	3.0	2.1	11.3	.9	14.3	17.3
Greenbrier	.1	.4	2.4	2.9	10.7	17.6	21.9	50.2	53.1
Hampshire	1.0	.5	4.1	5.6	2.6	13.5	1.0	17.1	22.7
Hardy	.8	.4	2.9	4.1	.9	4.7	.4	6.0	10.1
Jackson	.5	.3	1.8	2.6	.1	.4	.1	.6	3.2
Jefferson	(*)	—	(*)	(*)	(*)	.1	(*)	.1	.1
Kanawha	—	(*)	(*)	(*)	—	—	—	—	(*)
Lincoln	—	—	—	—	(*)	(*)	(*)	(*)	(*)
McDowell	—	—	(*)	(*)	—	—	—	—	(*)
Mason	.5	.2	1.5	2.2	.1	.6	—	.7	2.9
Mercer	(*)	(*)	(*)	(*)	—	—	—	—	(*)
Mineral	.7	.3	2.2	3.2	1.7	8.9	.7	11.3	14.5
Monongalia	—	—	—	—	(*)	(*)	(*)	(*)	(*)
Monroe	(*)	.4	2.3	2.7	2.9	4.8	6.0	13.7	16.4
Morgan	.7	.4	5.9	7.0	.8	4.2	.4	5.4	12.4
Ohio	(*)	(*)	(*)	(*)	—	.1	—	.1	.1
Pendleton	.1	(*)	.2	.3	.9	3.8	.9	5.6	5.9
Pleasants	(*)	(*)	.1	.1	(*)	(*)	(*)	(*)	.1
Pocahontas	.5	.4	2.8	3.7	2.1	6.2	3.0	11.3	15.0
Preston	(*)	(*)	(*)	(*)	.2	1.2	.1	1.5	1.5
Putnam	.4	.2	1.4	2.0	.1	.5	(*)	.6	2.6
Raleigh	(*)	—	(*)	(*)	—	(*)	(*)	(*)	(*)
Randolph	(*)	(*)	.1	.1	.2	1.0	.1	1.3	1.4
Ritchie	.3	.2	1.0	1.5	.1	.5	(*)	.6	2.1
Summers	(*)	(*)	.1	.1	.1	.1	.2	.4	.5
Tucker	(*)	(*)	(*)	(*)	.1	.6	.1	.8	.8
Tyler	(*)	(*)	(*)	(*)	.1	.1	(*)	.2	.2
Wayne	(*)	(*)	(*)	(*)	.5	1.3	.8	2.6	2.6
Webster	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)
Wirt	1.3	.7	4.7	6.7	1.1	5.7	.4	7.2	13.9
Wood	.1	.1	.5	.7	.1	7.5	(*)	7.6	8.3
Total	7.8	4.9	38.1	50.8	27.7	97.2	37.9	162.8	213.6

[a] Counties with no production are omitted.
* Less than 50 cords.

Headquarters of the Northeastern Forest Experiment Station are in Upper Darby, Pa. Field laboratories and research units are maintained at:

- Amherst, Massachusetts, in cooperation with the University of Massachusetts.
- Beltsville, Maryland.
- Berea, Kentucky, in cooperation with Berea College.
- Burlington, Vermont, in cooperation with the University of Vermont.
- Delaware, Ohio.
- Durham, New Hampshire, in cooperation with the University of New Hampshire.
- Hamden, Connecticut, in cooperation with Yale University.
- Kingston, Pennsylvania.
- Morgantown, West Virginia, in cooperation with West Virginia University, Morgantown.
- Orono, Maine, in cooperation with the University of Maine, Orono.
- Parsons, West Virginia.
- Pennington, New Jersey.
- Princeton, West Virginia.
- Syracuse, New York, in cooperation with the State University of New York College of Environmental Sciences and Forestry at Syracuse University, Syracuse.
- Warren, Pennsylvania.

Bones, James T., and David R. Dickson.
1976. **Pulpwood production in the Northeast—1974.** NE. Forest Exp. Sta., Upper Darby, Pa.
22 p., illus. (USDA Forest Serv. Resource Bull. NE-42)

An annual report based upon canvasses of pulpwood production in the Northeast, containing data about pulpwood production from roundwood in the 14 Northeastern States by counties and species groups, and pulpwood chip production from plant residues. Comparisons are made with the previous year's production data. Trends in pulpwood production for the past 12 years are shown. Also included is a list of the woodpulp mills that were operating in the region in 1974.

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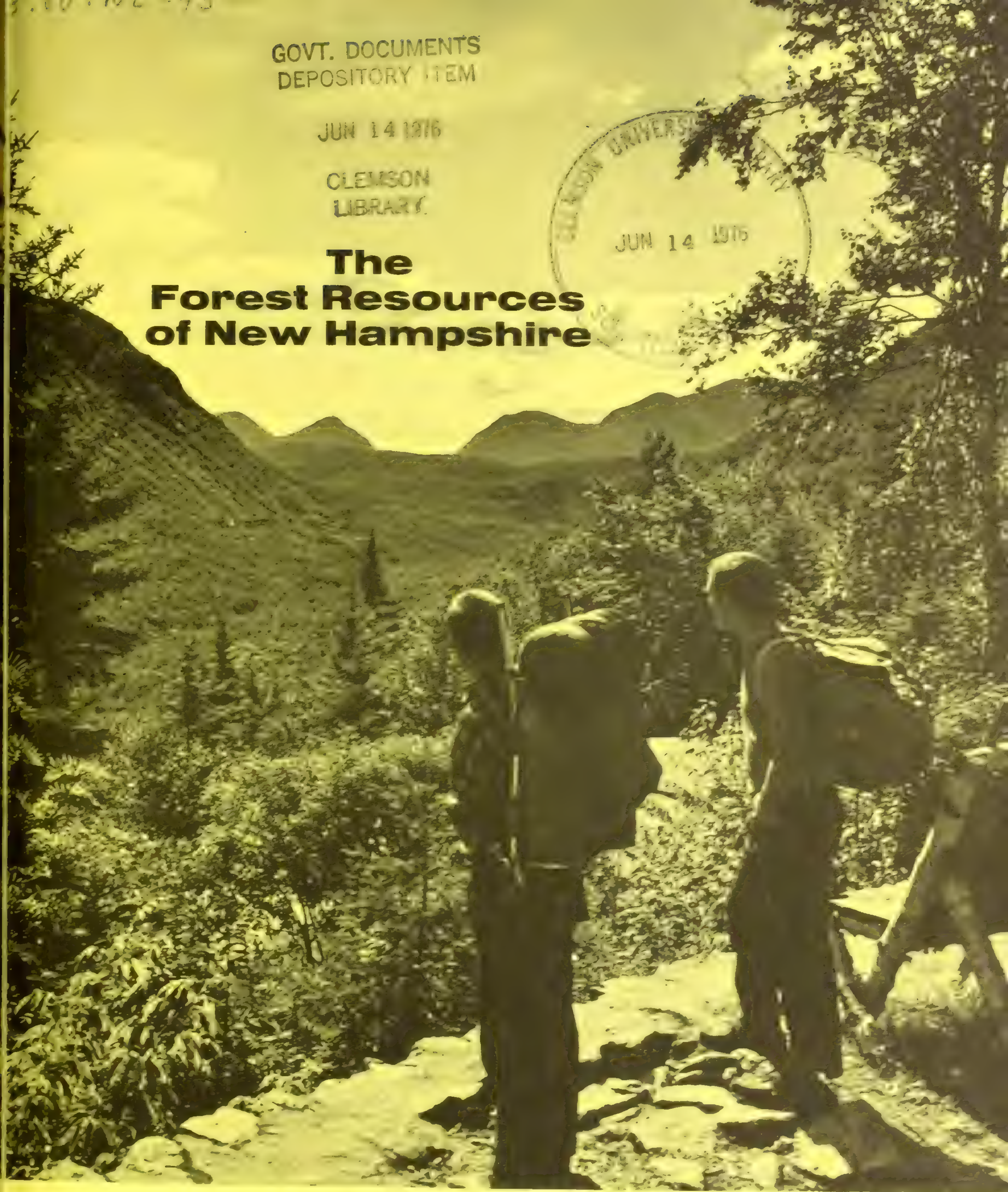
The Forest Resources of New Hampshire



USDA FOREST SERVICE RESOURCE BULLETIN NE-43
1976

FOREST SERVICE U.S. DEPARTMENT OF AGRICULTURE
NORTHEASTERN FOREST EXPERIMENT STATION
6816 MARKET STREET UPPER DARBY PA. 19082

FOREWORD

UNDER THE AUTHORITY of the McSweeney-McNary Forest Research Act of 22 May 1928 and subsequent amendments, the Forest Service, U.S. Department of Agriculture, conducts periodic forest surveys of all states to provide up-to-date information about the forest resources of the Nation.

The first forest survey of New Hampshire was made in 1947 and 1948 by the Northeastern Forest Experiment Station, with the cooperation of many individuals, forest industries, and state agencies. A second forest survey was completed in 1959.

This third survey was made in 1971 and 1972, again with the cooperation of many individuals and agencies. Special thanks are due to Theodore Natti, Director, New Hampshire Department of Resources and Economic Development, Bureau of Resource Development, and Roger M. Leighton, Cooperative Forest Management Supervisor, Cooperative Extension Service, University of New Hampshire, and their staffs, for their continuous assistance and support.

The third inventory of New Hampshire was directed by Carl E. Mayer, Forest Survey Project Leader. He was assisted by Joseph E. Barnard, who was responsible for the design of the inventory and sample selection as well as for supervision of data compilation. John R. Peters supervised the photo interpretation and the data collection by field crews. David R. Dickson applied the generalized data-processing systems, FINSYS, to the specific data needs of the New Hampshire inventory and produced summary tables for the State and by counties and units. Teresa M. Bowers assisted in the inventory design by performing all the calculations necessary for sample-size determination and plot selection. She was responsible for the coordination of key-punching and other data-preparation tasks and the final preparation and statistical checking of tables for the report. James T. Bones, with the assistance of state personnel, collected and compiled the data on timber-products output and industrial utilization of timber. He was assisted in the compilation phase by David R. Dickson and Teresa M. Bowers. Carmela M. Hyland was responsible for administrative and secretarial services.

Roland H. Ferguson and Joseph E. Barnard checked the consistency of the new inventory with previous inventories. They made frequent use of the TRAS model in this phase of the data analysis and in the 30-year projections of timber volumes.

The photo-interpretation phase of this inventory was completed in March 1972, and the last field plot was measured in December 1972. Final computer output was available in September 1973. Users of this report who have a need for more detailed information or analysis than is presented here should call on the Forest Survey project, Northeastern Forest Experiment Station, Upper Darby, Pa., 19082. *Users of this report are strongly advised to read carefully the definitions of forest-survey terms and the section on the reliability of the estimates in the appendix of this report.*

DICK SMITH PHOTO

COVER PHOTO: A hiker's view of Zeeland Notch. The forests, mountains, and waters of New Hampshire are the basis for a thriving recreation and tourist industry.

by Neal P. Kingsley

The Forest Resources of New Hampshire

The Author

NEAL P. KINGSLEY, research forester, received his bachelor's degree in forestry from the University of New Hampshire in 1961 and his masters degree in forest economics from the same university in 1963. He joined the Northeastern Forest Experiment Station in August 1962 and is now resource analyst in the Experiment Station's Forest Survey unit at Upper Darby, Pa.

MANUSCRIPT RECEIVED FOR PUBLICATION 25 AUGUST 1975

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DICK SMITH PHOTO

A wintry view of Moat Mountain from Wildcat Mountain.

Highlights

- New Hampshire has about the same acreage of commercial forest land that it had in 1948—nearly 4.7 million acres. This is about 400,000 acres more than the State had in 1776.
- 87 percent of the commercial forest land is privately owned.
- There are an estimated 87,500 owners of privately held forest land. They own an average of 46.7 acres each.
- The area of the maple/beech/birch type declined more than 860,000 acres, while the area of elm/ash/red maple increased by nearly 650,000 acres since 1948.
- Though the area of commercial forest land did not change, the volume of growing stock increased 60 percent, and the volume of sawtimber rose 39 percent during the past 25 years.
- White pine is the most abundant species in the State. Red maple replaced yellow birch as the most abundant hardwood species. Northern red oak is the most abundant hardwood sawtimber species.
- Although white pine is the most abundant species, sawtimber quality is poor: 89 percent is in grade-3 or poorer sawlogs.
- One tree in three in New Hampshire is too rough or rotten to be considered growing stock.
- Timber removals are well below the potential of the State's forests to produce.
- Present timber removals are at about half the 1948 level.

The Third Survey

EVER SINCE THE FIRST settlements were founded at Dover and Portsmouth in 1623, forests have been an important part of the New Hampshire economy. Indeed by 1680 the export of forest products from Portsmouth was such a thriving industry that the Provincial Council of New Hampshire petitioned the Lords of Trade in England to make Portsmouth a free port so that New Hampshire could maintain its competitive position in this trade *(Belknap 1831)*.

In the money-scarce colonial economy, timber became a medium of exchange. In 1680 taxes were frequently paid in lumber at the following rates *(Belknap 1831)*:

Merchantable white pine boards/m	30S
White oak pipe staves/m	£ 3
Red oak pipe staves/m	30S
Red oak hardwood/m	25S

A rough conversion to dollars at the then-prevailing price of silver shows the sum of these items to be worth about $17.

As settlers moved into the interior, they cleared land for homes and farms. From first settlement till about 1870, the area of forest land in New Hampshire declined steadily to a low of 2.8 million acres or 48 percent of the State's land area.

The development of railroads caught up with farming in New Hampshire about 1870. The more productive areas of the West and Midwest then had a competitive advantage over New Hampshire in the Boston and New York markets. More and more of the less profitable farms in New Hampshire were abandoned, and forest once more reclaimed the land. This trend continued without interruption until 1960.

Today one may find old stone walls, cellar holes, and other remnants of these farms even in isolated forest locations miles from habitation. It is difficult to realize that forests today cover more of New Hampshire's land than they did at the time of the American Revolution (fig. 1). New Hampshire today is the

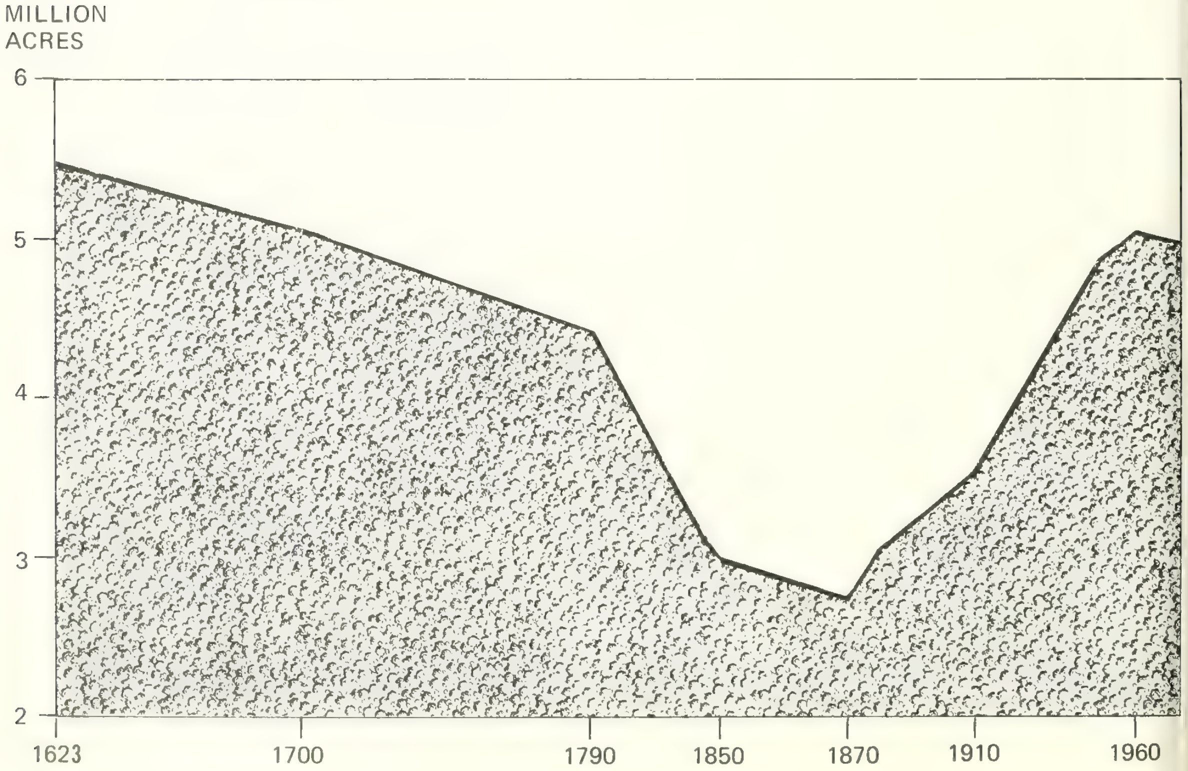


Figure 1.—The trend of forest land cover in New Hampshire since 1623.

second most heavily forested state in the Nation—second only to Maine.

Two industries that depend heavily on the forest thrive side by side in New Hampshire—timber production and outdoor recreation. Although timber production has declined substantially in recent decades, the growth of the recreation and tourist industry has been phenomenal. The challenge for the future is for the forests to continue to provide an increasing supply of timber products while at the same time enhancing those forest values upon which recreation and tourism depend.

This report includes a discussion and analysis of the results of the third forest survey of New Hampshire, which was completed in 1973. The first forest survey was completed in 1948 and the second in 1960 *(Larson et al. 1954; Ferguson and Jensen 1963)*. Through the years many definitions, procedures, and methods have been changed as a result of improved forest-inventory and data-processing techniques. This means that to analyze actual trends between forest surveys, the initial survey estimates must be put on a basis comparable to the resurvey estimates. The 1948 and 1960 estimates are valid for the procedures and definitions used at those times. The trends in commercial forest-land area and growing-stock volume, after adjustment of the 1948 data to present standards, are shown below:

Change in Area and Volume, 1948-73

	1948	*1973*	*Change*
Commercial forest land (thousand acres):	4,682	4,692	+10
Growing-stock volume (million cubic feet):			
Softwoods	2,085.5	3,139.9	+1,054.4
Hardwoods	2,023.1	3,438.7	+1,415.6
Total	4,108.6	6,578.6	+2,470.0
Sawtimber volume (million board feet):			
Softwoods	5,667.0	7,625.0	+1,958.0
Hardwoods	3,762.0	5,440.6	+1,678.6
Total	9,429.0	13,065.6	+3,636.6

Forest Area

Forests now cover 86 percent of New Hampshire's land area—a total of 4,985,100 acres. Of this, 4,692,000 acres or 81 percent of the land area is classed as commercial forest land. This is land that is producing or is capable of producing crops of wood and is not withdrawn from timber utilization by statute or administrative order.

Total forest area has declined only 1 percent since the previous forest survey in 1960. However, the area of commercial forest land in the State has declined 4 percent. Increases in both the area of productive reserved forest land and in unproductive forest land accounted for these changes. The area of productive reserved forest land rose from 23,500 acres in 1960 to 48,700 acres in 1973, due primarily to a change in classification of some of the forest land owned by town and city governments (from commercial forest land to productive reserved). The large increase in unproductive forest land was due mostly to the reclassification of 70,000 acres in the White Mountain National Forest. Forest land is sometimes reclassified in this manner when it has been shown that these areas are not capable of producing a previously specified volume of wood per year.

Commercial forest land is quite evenly distributed throughout the State. None of the 10 counties is less than 71 percent forested. The areas of commercial forest land range by counties from Rockingham, the most densely populated county, with 71 percent; to Coos and Carroll Counties, each with 86 percent.

Though the net change in commercial forest was only 0.2 percent since 1948, the changes were not evenly distributed throughout the State. For purposes of comparison, the State was divided into two geographical units. The Northern Unit consists of Carroll, Coos, and Grafton Counties; the Southern Unit consists of Belknap, Cheshire, Hillsborough, Merrimack, Rockingham, Strafford, and Sullivan Counties.

The Northern Geographic Unit increased 1.5 percent in commercial forest area while the Southern Unit declined 1.1 percent. Rockingham County showed the greatest decrease—down 3.5 percent, due primarily to increasing

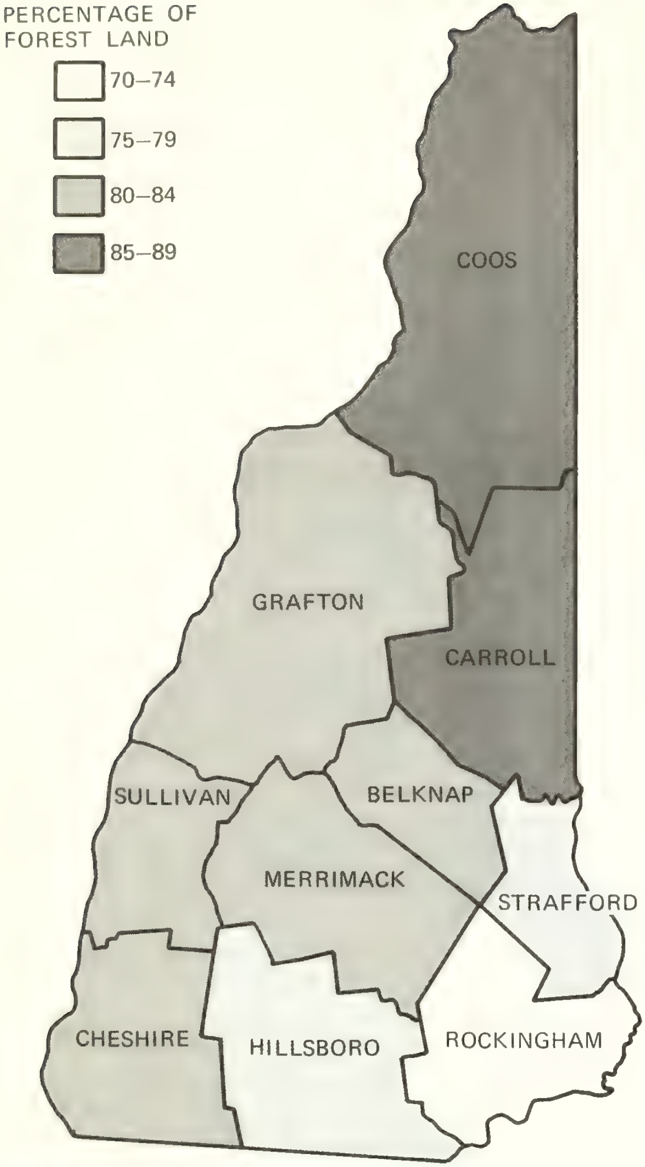


Figure 2.—Percentage of land area in commercial forest in New Hampshire, by counties, 1973.

urbanization. Grafton County showed the largest gain—up 2.8 percent, due mostly to continued farm abandonment. Figure 2 shows New Hampshire's counties by percentage of commercial forest land.

Of the 14 percent of New Hampshire that is not forested land, only 3 percent is in crop and pasture land. By contrast, around 1870 more than half the State's land area had been cleared, mostly for agriculture.

Forest-Land Ownership

Commercial forest land in New Hampshire is overwhelmingly in private ownerships. Only 13 percent is in public ownership. Most of the public ownership, 489,200 acres, is the White Mountain National Forest. Other federally-owned Commercial forest land totals 12,600 acres. State-owned commercial forest land totals 79,200 acres, while counties and municipalities own another 28,900 acres.

The 4.1 million acres that are in private ownerships are held by an estimated 87,500 owners. Of these owners, 86,100 are individuals; 1,000 are corporations of various kinds; and 400 are clubs, youth organizations, churches, and similar associations. The average size of ownership in New Hampshire is 46.7 acres. But ownerships range in size from as little as 1 acre to as much as 199,000 acres. Most owners—55,900 of them—hold fewer than 10 acres of forest land. In fact, the 31,600 who own more than 10 acres hold 96 percent of the privately owned commercial forest land in the State.

These estimates of privately owned commercial forest land are based on a canvass of forest-land owners that was conducted concurrently with the resurvey. The results of this study will be published separately.

Of the 86,100 individuals who own commercial forest land in New Hampshire, only 1,100 —1 percent—are farmers; and they own only 175,600 acres. The largest group of owners are white-collar workers, followed by skilled laborers, professional people, and retired persons.

Of the 1,000 corporations that own commercial forest land in New Hampshire, the largest group—600—are involved in real estate or other types of land development. This group of owners hold 127,300 acres of commercial forest land. Forest industries number fewer than 50, yet they hold the lion's share of the commercial forest land held by corporations—946,900 acres.

One of the main objectives of conducting the canvass of forest-land owners in New Hampshire is to enable us to estimate the volume of timber on privately owned commercial forest land that is now or may in the future be available for timber harvesting. Eighteen percent of the present forest-land owners in New Hampshire have at one time or another harvested timber from their land. These owners, though not large in number, own 65 percent of the private commercial forest land in the State. It is also interesting to note that only 4 percent of the owners said that they own forest land primarily for timber production, yet they own 23 percent of the private forest land.

Forest Types

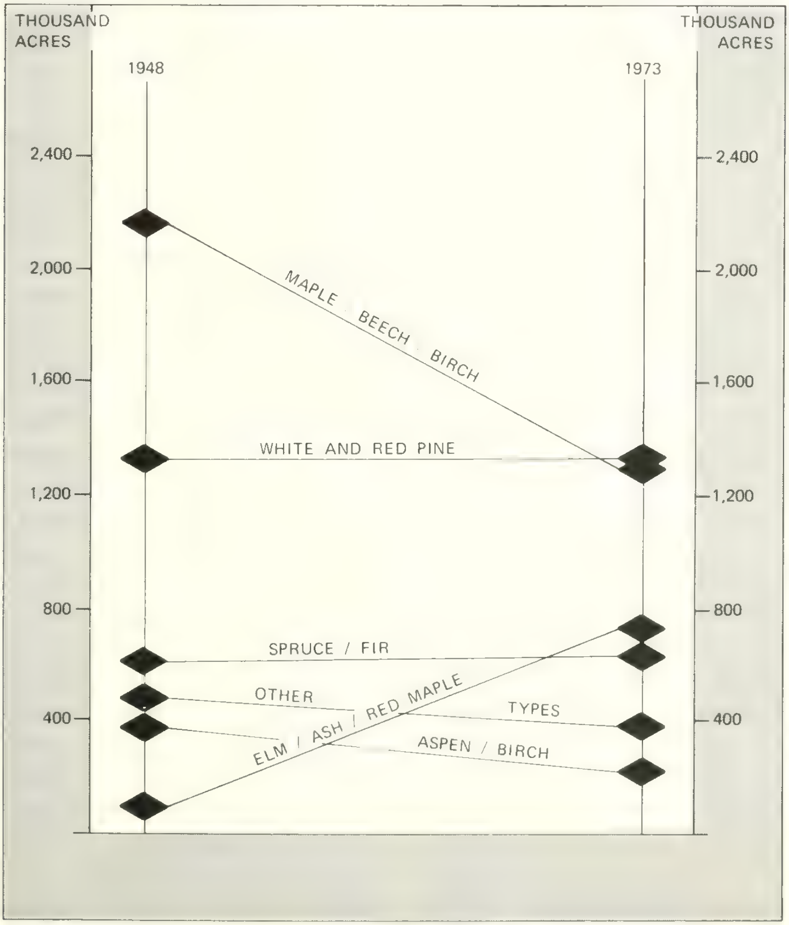
Forest type classifications and definitions used in this forest survey are essentially the same as those used in the 1960 forest survey. They differ, however, from those used in the initial forest survey of 1948. Because of these differences, caution must be exercised in the analysis of trends in forest types. Figure 3 shows the changes in area of the major forest types.

Twenty-four local forest types were recognized in this resurvey of New Hampshire. These local types were grouped into eight major types. For example, the major forest type—white pine and red pine—is made up of four local forest types found in New Hampshire: red pine (14,300 acres, mostly plantations), white pine (809,500 acres), white pine/hemlock (339,400 acres), and hemlock (181,400 acres).

White pine/red pine. The area of the white pine/red pine type changed very little between 1948 and 1973. In 1973 this type occupied 1,344,600 acres of commercial forest land. In 1948 it occupied 1,314,900 acres.

The reason why white pine was able to hold its own is that the demand for white pine box-lumber declined dramatically after World

Figure 3.—Changes in forest area in New Hampshire, by types, 1948-73.



A typical old-growth maple/beech/birch stand in New Hampshire.

War II. However, the demand for white pine lumber, particularly in the better grades, has always remained strong.

Spruce/fir.—The spruce/fir type occupies 635,900 acres of New Hampshire's commercial forest land, up slightly from the 1948 area of 607,000 acres. Most of this, 405,600 acres, is in the balsam fir local type. The red spruce/balsam fir local type accounts for 216,100 acres, and the northern white-cedar and white spruce types together account for the remaining 14,200 acres.

The spruce/fir type has been the mainstay of the woodpulp industry in the Northeast. It has been common practice in pulpwood harvesting to cut to a minimum diameter. This favors the restocking of cutover areas with balsam fir. However, recent trends in the woodpulp industry are away from the preponderant use of spruce and fir in favor of the utilization of hardwoods. Also, the industry has tended toward more clearcutting. These two trends may foster the development of more spruce/fir and spruce-fir/hardwood stands rather than pure balsam fir.

Maple / beech / birch. — The maple / beech / birch type (northern hardwoods) is the most extensive hardwood type in New Hampshire. With 1,308,300 acres, it ranks just behind the white pine/red pine type as the most extensive of all forest types in the State. The area of northern hardwoods in New Hampshire has declined. In 1948 this type covered 2,170,000 acres, but by 1973 it had dropped to 1,308,300 acres.

Although a substantial portion of this decline is undoubtedly real, some of it can be traced to changes in the method of determining forest types. In the initial forest survey, forest types were classified ". . . according to the species, or species group, that makes up the major part of the stand in terms of board-feet in sawtimber stands or number of stems in other stands". It is common for maple/beech/birch sawtimber stands to contain a large number of red maple poletimber and smaller trees in an understory. Under the earlier system of forest typing, these trees would not have been considered in sawtimber-size stands. Undoubtedly, if these stands had been typed according to the 1973 procedure, which is based on the basal-area stocking of all live trees, many would have been classified as elm/ash/red maple stands.

This change in the method of classification, however, cannot account for all of the decrease in the area of maple/beech/birch. Red maple is not one of the more marketable species. For this reason many stands were harvested in which only the most salable trees, mainly sugar maples and birches, were harvested. This practice had the effect of converting many maple/beech/birch stands to red maple. A higher demand for red maple for pulpwood may help to curb this practice in the future.

Elm/ash/red maple.—This type now covers 737,600 acres of commercial forest land in New Hampshire—up from 90,000 acres in 1948 and 203,600 acres in 1960. As mentioned previously in the discussion of the maple/beech/birch type, part of this increase is due to changes in the methods of determining forest type, while the rest is the result of past harvesting practices. However, an additional factor in considering the increased area of elm/ash/red maple is the pioneer character of the type. As farms and pasture revert to forest land, this type is often one of the first to become established on the area. This is particularly true of the more moist bottomland sites.

Oak types.—In New Hampshire the oak/hickory type group accounts for 322,900 acres. The northern red oak local type makes up 251,100 acres of the total. The remainder is made up of a mixture of other oak types, including the black oaks and the white oaks. It should be noted that although this major type is named oak/hickory, hickory is found only in southern New Hampshire and is not common in the oak/hickory type found elsewhere in the State. Throughout the central and southern portions of this type's range, which includes most of the Appalachian highlands, hickory species are common.

Another oak type is oak/pine. This type covers 72,700 acres, mostly in the white pine/red oak/white ash local type.

Aspen/birch.—This type, although declining in area, is still an important type in New Hampshire. In 1948 the aspen/birch type covered 381,000 acres, but by 1973 it had declined to 234,200 acres. Probably the most important reason for the drop in this type is the reduction in the number and extent of forest fires in New Hampshire. This type, another pioneer type, can establish itself on relatively poor sites. Both of its common components—quaking aspen and paper birch—require open sunlight and mineral soil for seed germination and seedling development. They are natural occupants of sites where fire or other disturbances have destroyed or modified the organic soil layer.

Stand-Size Classes

Acreages in stand-size categories for 1948, 1960, and 1973 are not on the same basis, so differences do not necessarily represent actual trends.

The stand-size classes in New Hampshire are distributed about evenly. In 1973, 41 percent of the commercial forest land in the State was in sawtimber-size stands, 33 percent was in poletimber stands, and 26 percent was in seedling-and-sapling stands and nonstocked areas.

Although stand-size is evenly distributed among all forest types, it varies considerably among types. Sixty-two percent of the white pine/red pine type and 44 percent of the maple/beech/birch type is in sawtimber stands. By contrast only 22 percent of the elm/ash/red maple type and 27 percent of the spruce/fir type are in sawtimber-size stands. Past cutting practices associated with these types have probably contributed to these differences. Both white pine/red pine and maple/beech/birch are utilized mostly for sawtimber, so trees are allowed to attain larger sizes. Spruce/fir has been extensively utilized for pulpwood, so the diameter of each individual tree is not a major consideration. The explanation for elm/ash/red maple is somewhat different. In this type the low proportion of sawtimber stands may be due to the fact that the type occupies many poor sites where growth is slow.

Stocking and Area Condition

Ninety-four percent of the commercial forest land in New Hampshire is fully stocked or overstocked with trees of all kinds. This means that, on 94 percent of the commercial forest land, 100 percent or more of the optimum growing potential of the site is being utilized. At first glance this situation looks favorable.

But the rub comes when we consider only those trees that are considered growing stock. Only 54 percent of the commercial forest land is fully stocked or overstocked with growing-stock trees. This means that nearly half the commercial forest land in New Hampshire is not adequately stocked with potentially merchantable trees and that valuable growing space is occupied by inferior trees. A look at the numbers and classes of trees in New Hampshire's stands reinforces this conclusion. Of the 805 tree on the average acre of commercial forest land in New Hampshire, 275 trees—one in three—are classed as rough or rotten.

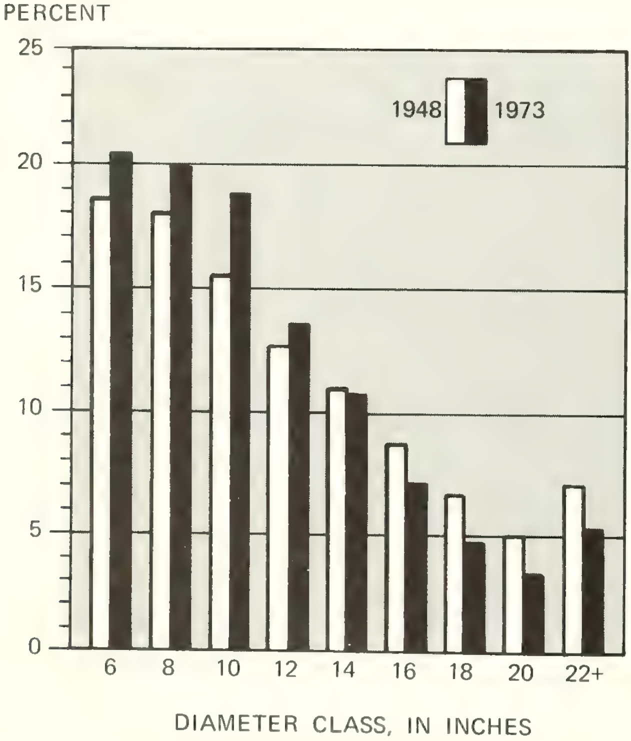
The average volume of growing stock per

acre of commercial forest land has risen 60 percent since 1948. In 1948 there were 878 cubic feet of growing stock on the average acre, and in 1973 there were 1,402. The volume of sawtimber per acre in New Hampshire also increased, although not as spectacularly as did all growing stock. In 1948 there were 2,014 board feet on the average acre; by 1973 the stocking had risen to 2,785, an increase of 38 percent. The biggest single cause for this increase in volume per acre is the decline in the rate of timber harvesting since 1948.

Timber Volume

Despite the fact that the area of commercial forest land has remained approximately constant since 1948, the volume of growing stock increased 60 percent during the 25-year period. Softwood volume gained 50 percent while hardwoods gained 70 percent. This substantial increase is the result of increasing stand density and a declining demand for timber during the 25-year period.

Figure 4.—Percentage of growing-stock volume in New Hampshire, by diameter classes, 1948 and 1973.



The total volume of growing stock in New Hampshire today stands at 6.6 billion cubic feet, compared with 4.1 in 1948 and 4.8 in 1960. Of the total, softwoods account for 3.1 billion cubic feet and hardwoods for 3.5 billion.

Sawtimber volume did not gain as much as the volume of growing stock gained. Total sawtimber volume rose from 9.4 billion board feet in 1948 to 13.1 billion in 1973, a gain of nearly 39 percent. Softwood sawtimber rose 34 percent from 5.7 billion board feet in 1948 to 7.6 in 1973. Hardwoods did somewhat better: they gained 45 percent, from 3.8 billion board feet in 1948 to 5.4 billion in 1973.

In addition to the 6.6 billion cubic feet of growing stock, there are 537 million cubic feet of sound wood in rough trees and another 327 million cubic feet in rotten trees. This is usable wood in trees that are either too crooked or too rotten to be classified as growing-stock trees. In New Hampshire nearly one tree in five over 5 inches dbh is a rough or rotten tree.

The distribution of growing-stock volume by diameter classes has changed somewhat since 1948. Today, a higher proportion of the volume is in trees 12 inches in diameter or smaller than was the case 25 years ago (fig. 4). This change can probably be traced to cutting practices that favor the harvesting of only the larger trees and the development of a high volume of red maple poletimber trees.

Sawlog Quality

The quality of hardwood logs in New Hampshire has declined primarily as a result of the decrease in average diameter of sawlog-size trees. In 1948 sawlog grade-1 and -2 logs accounted for 36 percent of the sawtimber inventory, but by 1973 the percentage had declined to 29 percent. In 1973, there were 519 million board feet in grade-1 hardwood logs and 1.0 billion board feet in grade-2 hardwood logs.

Hardwood sawlog grades are based on the number of potential clear cuttings in standard lumber logs and on the structural usefulness of timber-and-tie logs. Therefore the greater the proportion of volume in clear cuttings that can be expected from a log, the higher the grade. One factor that influences this potential yield greatly is the diameter of the log. A grade-1 sawlog must have a minimum diameter inside bark at the small end of 13 inches. It is highly unlikely that a 14-inch dbh tree could contain such a log. In 1948, 55 percent of New Hampshire's sawtimber inventory was in trees larger than 14 inches, but by 1973 this proportion had dropped to 42 percent.

White and red pines were the only softwood species graded. Less than 2 percent of the sawtimber volume in these species was in grade-1 logs and 10 percent was in grade-2 logs. This extremely low proportion of high-quality white pine has two primary causes: heavy incidence of white-pine weevil attack throughout most of the State, and past harvesting practices that have favored the removal of only high-quality white pine while the poorer trees have been left to occupy growing space.

Volume by Species

The forests of New Hampshire contain a wide variety of species growing under an even wider variety of stand conditions. The variety of timber products produced in New Hampshire is just as diverse. Volume is the basis for judging the importance of a species for product use, and volume changes for a species can have important implications. For this reason a discussion of timber volume by

Figure 5.—Growing-stock volume in New Hampshire, by major species, 1948 and 1973.

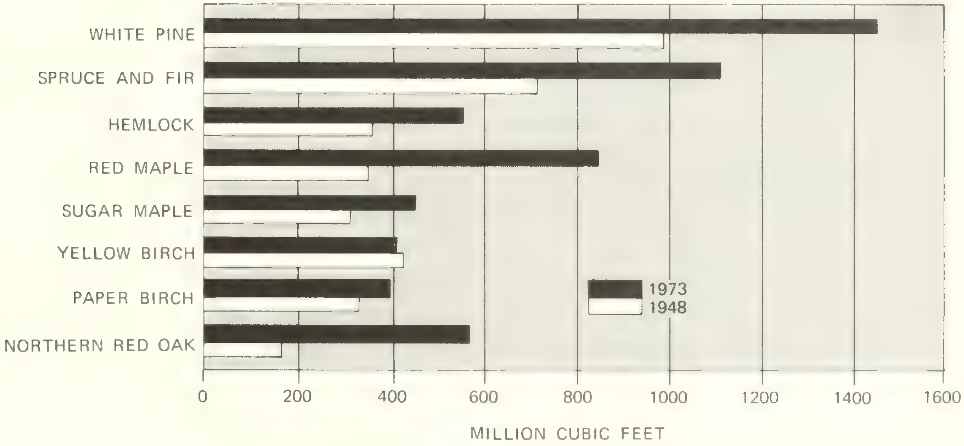
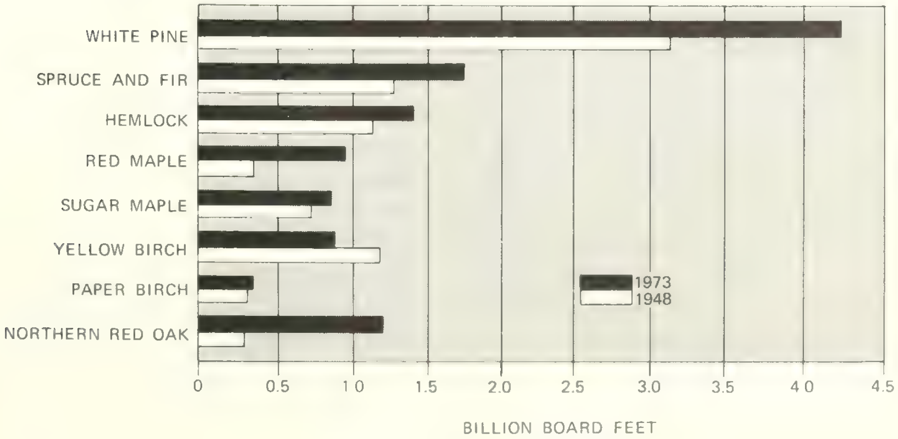


Figure 6.—Sawtimber volume in New Hampshire, by major species, 1948 and 1973.



major species is important. Figures 5 and 6 show a comparison of growing stock and sawtimber in 1948 and 1973, by major species.

White pine.—White pine is the most abundant species in New Hampshire, accounting for 1.5 billion cubic feet—up from less than 1 billion in 1948. White pine sawtimber volume also gained, but not as dramatically as did growing stock. In 1973 there were 4.3 billion board feet of white pine compared to 3.1 billion in 1948.

Although white pine is found throughout New Hampshire, it is most abundant in the southeastern quarter of the State and, to a lesser extent, along the Connecticut Valley in west central New Hampshire. Hillsborough, Merrimack, and Rockingham Counties have the largest concentrations of white pine. Throughout this region there are many sites with light, sandy, yet moist soils that are favorable to white pine development. Also in this region are many former farm fields that are in the process of reverting or have reverted to forest land. White pine frequently acts as a pioneer species under such conditions. Because of a lack of competition from surrounding trees, white pine frequently develops as short-boled and extremely limby individuals, known as "old-field pines". Such trees have limited value as lumber. About the only uses for old-field pines are pine novelties or rustic furniture.

White pine was once the mainstay of the New Hampshire lumber industry. In 1907 white pine lumber production reached its peak of 397 million board feet—53 percent of all the lumber produced in the State that year. By 1972 white pine sawlog production had dropped to 97 million board feet, although it still accounted for 53 percent of the State's sawlog production.

Spruce and fir.—Spruce and fir are the second most abundant species in the State. In 1973 these species accounted for 1.1 billion cubic feet of growing stock—up 53 percent from 711 million in 1948. Because of the generally small size of balsam fir and much of the spruce, together they accounted for only 1,787 million board feet of sawtimber.

Spruce and fir have been the staple raw material for New Hampshire's woodpulp industry. However, recent trends in this industry are toward a greater use of hardwood species for pulp. A recent high demand for spruce and fir studs has buoyed the demand for these species. In 1972, 11 percent of the sawlogs produced in New Hampshire were spruce and fir. These species accounted for more sawlog volume than any other species except white pine.

Hemlock.—The volume of hemlock growing stock has risen 57 percent since 1948, from 358 million cubic feet in 1948 to 546 million in 1973. Hemlock sawtimber did not do quite as well. It increased only 29 percent over the period, to 1.5 billion board feet. It is now the third most abundant sawtimber species, replacing yellow birch.

The increase in hemlock volume is a result of the increased density of forest stands in New Hampshire, plus a low demand for hemlock sawtimber. As stands become more dense, the shade-tolerant species become a more important component. Hemlock is one of the most shade-tolerant species and is a component or associate of the three most prevalent forest types in the State: maple/beech/birch, white pine, and spruce/fir.

Throughout most of the past 25 years, the demand for hemlock has been low. It is not a preferred species for pulping; and it is hard and somewhat brash, which makes it generally unsuitable for lumber except where strength is important. The rebirth of a stud industry in the Northeast may increase the demand for hemlock sawlogs.

Red maple.—The greatest increase in volume of the major species was the increase of red maple. Between 1948 and 1973 the growing-stock volume of red maple rose 146 percent. In 1948 red maple growing stock totaled 347 million cubic feet, but by 1973 it had risen to 855 million cubic feet. Red maple sawtimber volume rose 165 percent during the same period—from 369 million board feet to 978 million.

Though part of the increase in the elm/ash/red maple forest type can be attributed to changes in the method of determining forest types, the same cannot be said for the increase in the volume of red maple. Though red maple is the major component of the elm/

ash/red maple type, it is also a commonly associated species in all of the other major types found in New Hampshire. Red maple is not in much demand. Thus, harvesting practices that remove only those species in high demand, but leave such species as red maple, have contributed to the increase in the volume of red maple. As the use of hardwoods increases in woodpulp manufacture, and as the particle-board industry develops, maybe red maple will be utilized more extensively.

Sugar maple.—Of all the major species, sugar maple showed the smallest increase in volume. Sugar maple growing stock gained 44 percent during the 25-year period—from 313 million cubic feet in 1948 to 450 million in 1973. Sawtimber volume increased less—16 percent. In 1948 sawtimber sugar maple totaled 775 million board feet, and in 1973 it totaled 896 million board feet. A consistently high demand for sugar maple, particularly for furniture stock, has slowed the increase in volume of this species.

Yellow-birch.—Yellow birch was the only major species that decreased in volume. Growing-stock volume of yellow birch declined 4 percent, while sawtimber volume dropped 23 percent. In 1948 yellow birch growing stock totaled 433 million cubic feet, but by 1973 it was down to 416 million. In 1948 sawtimber volume stood at 1.2 billion board feet, and yellow birch was then the most abundant hardwood species in the State. By 1973 the volume had declined to 938 million board feet. Similar declines have been observed in Maine and Vermont.

Several factors have contributed to the decline in volume of yellow birch. Perhaps the most important was the high demand for yellow birch for veneer and turnery stock. Cutting practices that do not favor the regeneration of yellow birch have also contributed to the decrease in volume. In 1958-72 the average annual growth of yellow birch sawtimber was was 6.2 million board feet, while removals averaged 15.5 million board feet—a ratio of 2.5 to 1.

Paper birch.—The volume of paper birch growing stock rose 27 percent during the quarter century. In 1948 paper birch growing stock totaled 314 million cubic feet, and by 1973 it had risen to 400 million cubic feet. On the other hand, paper birch sawtimber rose a mere 3 percent during the period, from 339 to 349 million board feet. Paper birch, like yellow birch, is in great demand, particularly for furniture and cabinet stock and turnery bolts.

Northern red oak.—Once a relatively minor species in New Hampshire, northern red oak has become the second most abundant hardwood growing-stock species and the most abundant hardwood sawtimber species. In 1948 northern red oak growing stock totaled 164 million cubic feet, and by 1973 it had risen to 570 million. Red oak sawtimber rose from 308 million board feet to 1.2 billion—an increase of more than 300 percent.

The demand for northern red oak sawtimber in New Hampshire is, and has been, quite low. From 1958 to 1972, the average growth of red oak sawtimber exceeded average removals by more than 4.3 to 1. In earlier times, oak was used in shipbuilding and for heavy structural timbers. In recent decades the wood shipbuilding industry has all but disappeared, and heavy structural members are made either of steel or western timber species. Thus northern red oak has been left to grow.

Growth and Removals

To understand how the inventory changes, we compare the average annual growth with the average annual removal—how much growth of wood the trees put on versus how much volume was cut or otherwise lost.

The volume of growing stock in New Hampshire increased 2.5 billion cubic feet from 1948 to 1973, and sawtimber increased 3.6 billion board feet. This increase was due almost entirely to a decrease in the rate of harvesting. In 1948, 131.7 million cubic feet of growing stock were harvested, but in 1972 only 64.4 million were harvested. Net annual growth of growing stock was 3.6 percent of the inventory in both years—148.6 million cubic feet in 1948 and 236.3 million in 1972.

Cutting of sawtimber also declined, from 403 million board feet in 1948 to 166 million in 1972. The sawtimber growth rate rose from 3.4 percent to 4.1 percent in the 25-year per-

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Starting the undercut.

iod. This increase indicates that there was a greater volume in large trees in 1973 than there was in 1948.

Change in the Inventory

The annual change in growing stock and sawtimber volume is equal to net growth less timber removal. Net growth is the sum of several factors. The first of these factors is growth on the initial inventory and ingrowth (the growth of trees that became large enough to be considered inventory). The sum of these is gross growth. Net growth is gross growth less changes in merchantability (cull-increment and mortality). It is the components of net annual growth that the forester seeks to manipulate through forest management.

An unusual change in any one of these factors can cause a substantial change in the annual inventory. For example, a sudden insect attack may increase mortality or cull increment. A sudden increase in timber demand may increase timber removal, which in turn would reduce the rate of increase in the inventory.

Because of changes in procedure since 1948, the components of annual change in the inventory can be broken out only for the 1958-72 period. For most species in New Hampshire, ingrowth is the most important component of growth. Of the average annual gross growth, this component accounted for 58 percent of the 252.1 million cubic feet. An important reason why ingrowth is such a large part of growth is the long period between surveys. As the interval between surveys increases, trees that were less than 5 inches in diameter at the initial inventory constitute a greater part of the average annual gross growth. Another factor is that timber removals usually take out the larger trees. In fact, for trees 17 inches dbh and larger, removals were more than three times the average annual growth in 1958-72.

Cull increment is the volume that became rough or rotten, and growing-stock mortality is the volume of growing-stock trees that have died since the previous inventory. Together, cull increment and mortality reduced gross growth by 18.9 percent. This is more than half as much as the average annual removal of growing stock during the period. The volume of each of the components of average annual net change in growing stock between 1958 and 1973 is shown below:

	Million cubic feet	*Percentage of gross growth*
Accretion (growth on surviving trees)	104.5	– 41.5
Ingrowth (volume and growth that became poletimber)	147.6	– 58.5
Gross growth	252.1	100.0
Cull-tree increment	– 26.9	– 10.7
Growing-stock mortality	– 20.6	– 8.2
Net growth	204.6	81.1
Removals	– 66.3	– 26.3
Net change in the inventory	138.4	54.9

Net Growth and Removal

Analysis of the trends in net annual growth of growing stock and in growing-stock removal shows that removals have declined faster than net annual growth has increased. However, the decline in removal was not equally distributed between the two major species groups—softwoods and hardwoods. Cutting of softwoods has declined steadily from 92.1 million cubic feet in 1948 to 32.3 million in 1972. In 1948, growth of softwoods was only 77.0 million cubic feet, or 84 percent of removals. Growth of hardwoods, on the other hand, showed a slower rate of decline, and then swung up slightly in the last 2 years. At no time during the period did removals of hardwoods exceed net annual growth.

In 1972 the removal of growing stock as a percentage of net annual growth was about 20 to 30 percent. Two notable exceptions were yellow birch and red maple. The harvest of yellow birch growing stock was 129 percent of net annual growth, and removal of sawtimber was more than 123 percent of growth. Red maple has the lowest ratio of removal to growth of all major species—only 18 percent. The annual growth and removal of growing stock for the major species in New Hampshire are shown in figure 7.

Timber-product Output

The timber-product output estimates shown in tables 25 to 29 should not be confused with the estimates of annual timber removals shown in tables 20 and 21. Timber-product output is that portion of the total timber harvested that was used for products. In addition to timber removed for products, timber removals include logging residues and other removals such as those due to land-clearing, land-use changes, and so forth. In this section, data obtained from the New Hampshire Department of Resources and Economic Development, Division of Resources Development, and other data gathered as part of the resurvey, were used in analyzing the 1972 timber harvest and the output of timber products.

After 1830, lumber production in New Hampshire began to climb steadily, spurred on by the steam sawmill, railroads, and the emergence of large markets to the south. By 1869 the State was producing 253.4 million board feet of lumber (fig. 8). Most of this lumber was pine, hemlock, and spruce. Also,

Figure 7.—Annual growth and removal of growing stock in New Hampshire, 1972.

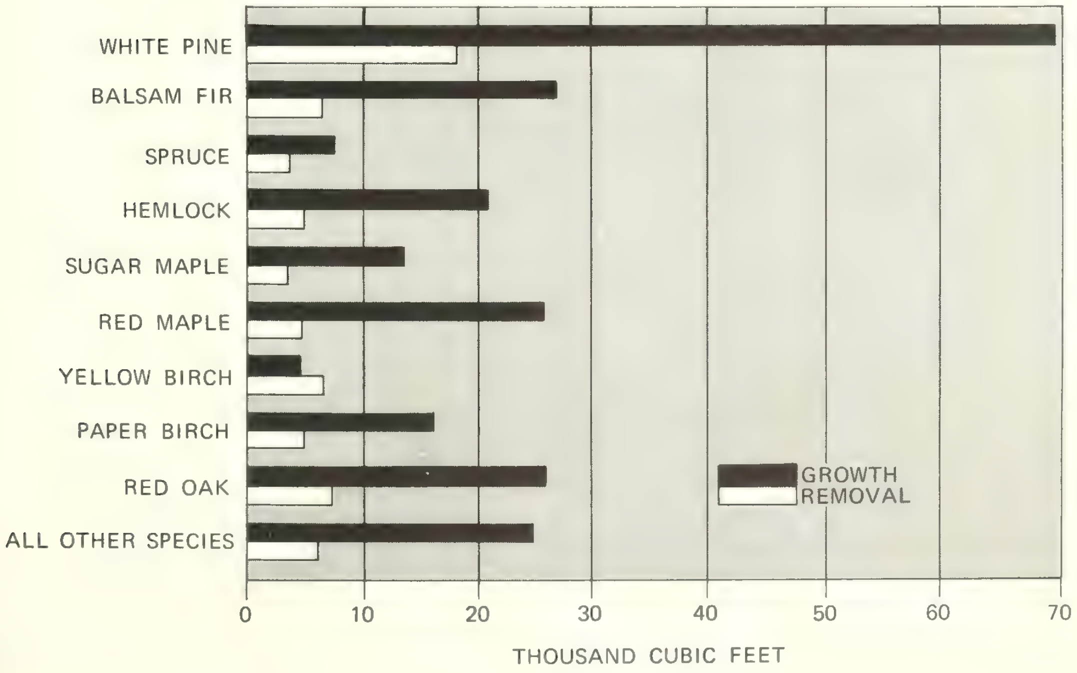
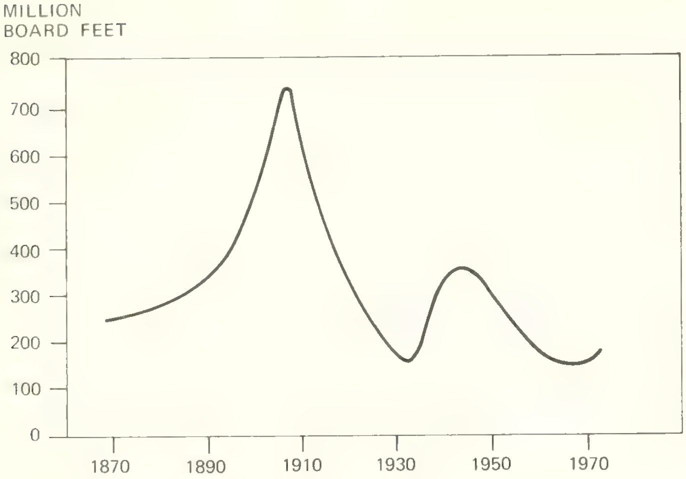


Figure 8.—The trend of lumber production in New Hampshire, 1869 to 1972.



about this time the use of wood for pulp was being developed in Massachusetts *(Kingsley 1971)*. By 1907 New Hampshire's lumber industry reached its peak production—754 million board feet *(Steer 1948)*. In the same year the youthful woodpulp industry consumed 430,000 cords. After 1907 the lumber industry began a general decline until it hit a bottom of 130 million board feet in 1932. After 1932 it began a slow recovery and then was spurred on by the timber-salvage operations after the 1938 hurricane and the demands of World War II. After World War II, production again slumped until in 1972 it stood at 182 million board feet.

The woodpulp industry continued to grow after 1907, only to be slowed by the depression and the development of a satisfactory means of pulping southern softwoods in the 1930s. Since World War II, New Hampshire has been steadily losing ground in pulpwood production because most of its mills cannot compete with the more modern and efficient mills of other regions. In 1972, pulpwood production stood at 311 thousand cords *(Bones and others 1974)*. The development of woodpulping methods that utilize hardwoods has spurred a modest recovery in the industry that may become substantial (fig. 9).

In 1972 New Hampshire had 185 primary wood-processing plants. These included 142 sawmills, 2 woodpulp mills, 16 wood-chipping plants, and 25 other plants that produced such products as specialty veneers, rustic fencing, cooperage, wood turnings, and excelsior (fig. 10). These plants, along with the other secondary wood-using plants, are an important segment of New Hampshire's economy. According to the 1967 Census of Manufactures, the wood-using industries in the State included 457 establishments that employed 12,700 people—13 percent of the State's manufacturing labor force *(U.S. Bureau of Census 1967)*. Only the leather and footwear industry and the electrical-equipment and supplies industry employed more people. The wood-using industries paid $71,900,000 in wages and salaries and accounted for $318,600,000 worth of goods manufactured in the State—19 percent of the State total. These industries included loggers, sawmills, planing mills, wood turners, furniture manufacturers, woodpulp mills, papermills, and many other firms that use wood in one form or another.

The harvest of forest products—sawlogs, pulpwood, and the like—also represents a substantial dollar return in the State. The 50.2

Figure 9.—The changing timber-products mix New Hampshire, 1952-72.

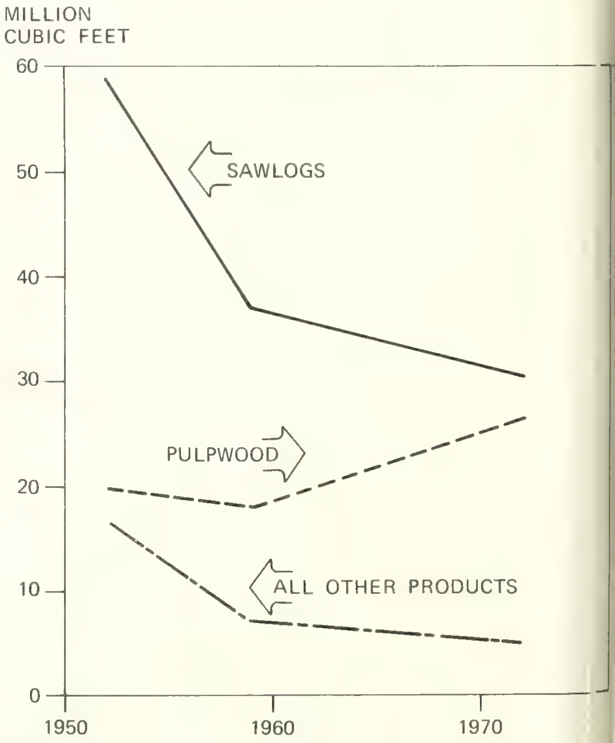
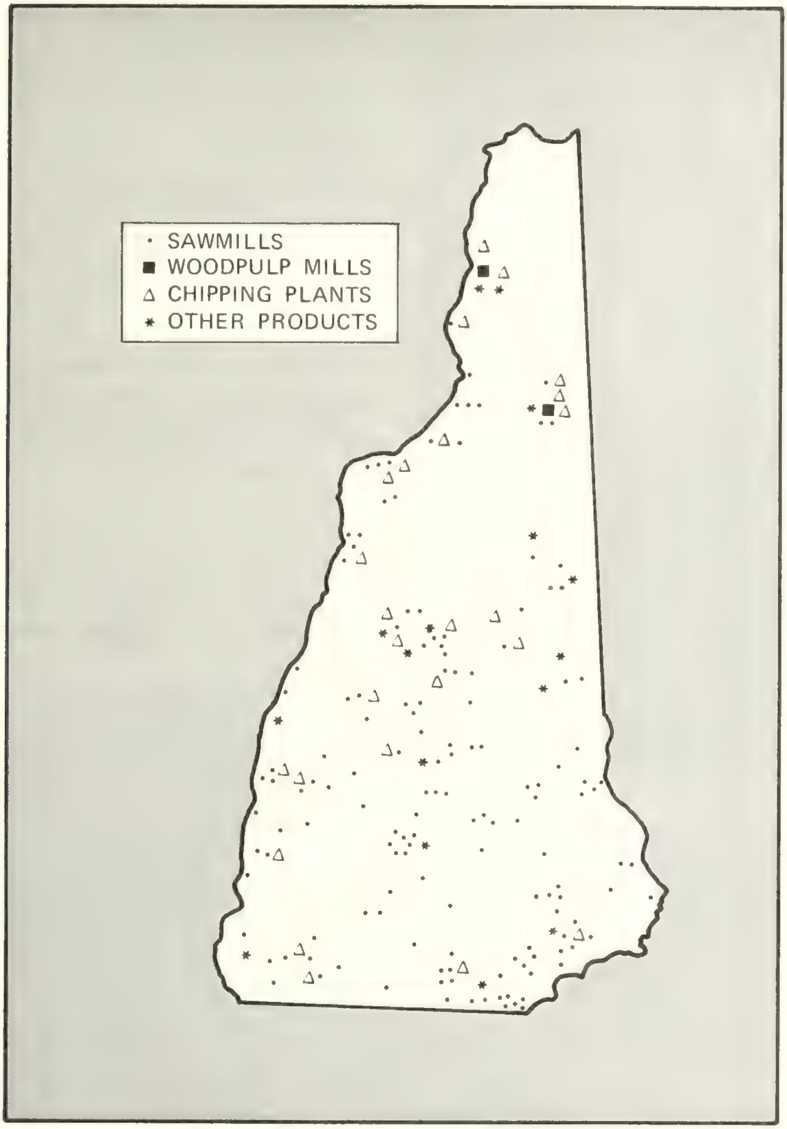


Figure 10.—Distribution of primary wood-processing plants in New Hampshire, 1972.



million cubic feet of timber that was harvested in 1972 is estimated to have had a value before it was harvested (stumpage value) of more than $5 million *(Engalichev and Sloan 1973)*. After it was harvested and delivered to the mill it had a value in excess of $21 million. To put this a different way: each acre of commercial forest land in New Hampshire supplied $1.07 worth of stumpage and $4.48 worth of delivered logs and bolts. This says nothing of the jobs provided, the potential capacity of the forest to produce timber, or of the other values this forest land supplied.

Sawlog Production

Sawlog production in New Hampshire stood at 182 million board feet in 1972. This was a 39-percent drop from the 1952 production of 297 million board feet. Although the total production of sawlogs in the State has declined, the decline has not been evenly distributed. In 1905, 90 percent of the sawlog harvest was softwoods, but by 1972 the softwoods accounted for 73 percent. For individual species, these changes are even more dramatic. In 1905, for instance, maple accounted for only 1 percent of the sawlog harvest; by 1972, it had

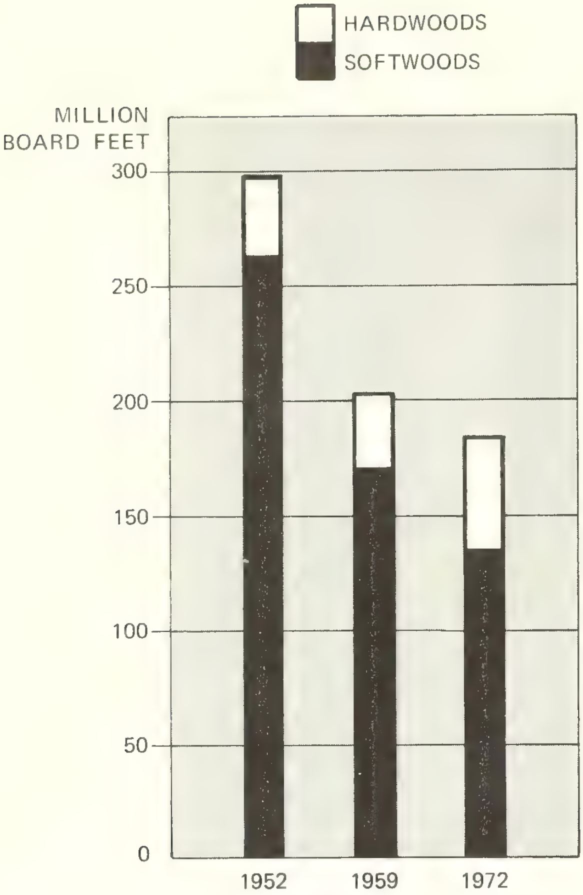


Figure 11.—Sawlog production in New Hampshire in 1952, 1959, and 1972.

risen to 9 percent. Because the total output of sawlogs has declined over this same period, the actual changes in output are even more dramatic (fig. 11).

Pulpwood Production

In 1972, pulpwood production in New Hampshire stood at 200,700 standard cords of round pulpwood. This represents a decline of 19 percent form the 1952 production of 247,500 cords. In addition, New Hampshire produced the equivalent of 110,700 cords as chipped residues from wood-using plants in 1972. These are primarily chipped sawmill slabs and edgings. In 1952 very little of the State's pulpwood output was in the form of chipped residues. Therefore, when we add this output of chips to the roundwood production, we find that total production actually increased somewhat over the 20-year period.

Another important change that has occurred is the shift to hardwood pulpwood, particularly roundwood (fig. 12). In 1959, 52 percent of the State's production of round pulpwood was softwood, principally spruce and fir. By 1972, the balance had shifted radically, and 68 percent of the round pulpwood was hardwood.

This change was fostered by the conversion of the woodpulp mills to pulping processes capable of utilizing a greater proportion of hardwood. In 1952, the two pulpmills in the State used the sulfite pulping process, which requires a high proportion of softwood. By 1972 both were using the sulfate (Kraft) process, which can utilize a high proportion of hardwood.

This change has not been restricted to New

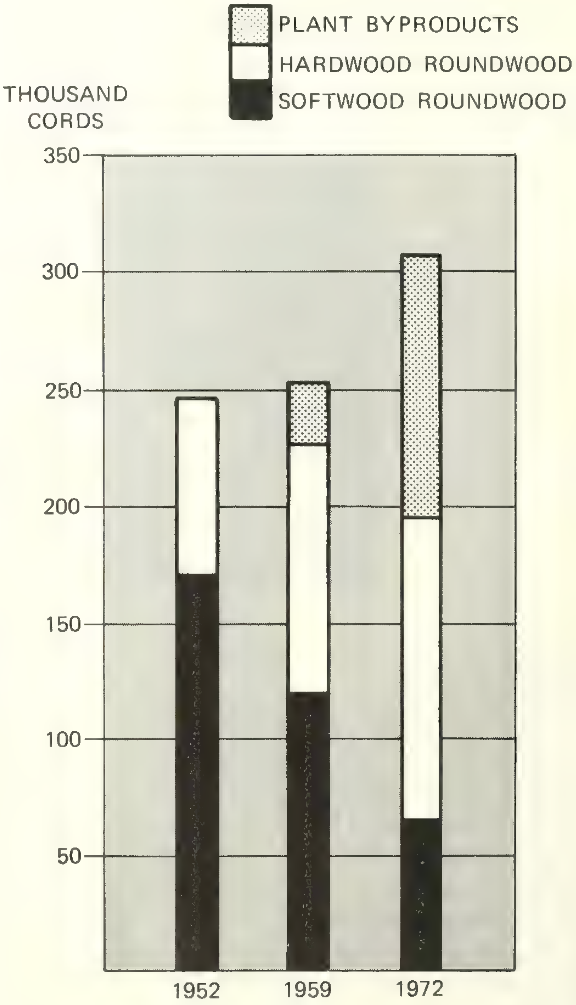


Figure 12.—Changing sources of pulpwood in New Hampshire in 1952, 1959, and 1972.

Hampshire. Sulfate pulpmill capacity in the 14 northeastern states rose from only 1,400 tons per day in 1955 to 5,900 tons per day in 1969, and the sulfate process is now the one most commonly used in the region *(Kingsley 1971)*. This shift to hardwood as a major source of pulpwood not only broadens the raw material base for the region's woodpulp mills, but also can have a long-term beneficial effect on the region's forests by providing a use for the large volumes of lower quality hardwoods that have built up over the years.

Veneer-Log Production

In 1952 New Hampshire had three veneer mills. By 1972 it had only one specialty veneer plant. During the same period, veneer-log production plummeted 85 percent—from 14.1 million board feet in 1952 to only 2.1 million in 1972. Today many veneer logs harvested in New Hampshire are shipped out-of-state for manufacturing, principally to Vermont.

Yellow birch accounts for 51 percent of the New Hampshire veneer-log harvest. White birch is the second most commonly harvested: 16 percent. The remainder is composed of other hardwood species, mainly beech, hard maple, and oak. Small quantities of ash, soft maple, and other hardwoods are also harvested for veneer logs. In 1972, no softwood species were harvested for veneer logs in New Hampshire.

Other Products

Turnery bolts.—New Hampshire has several wood turneries. These mills primarily use bolts of yellow birch, white birch, and hard maple, from which they turn, rout, or shape blanks for products like paint-brush handles, chair legs, and spindles.

The textile bobbin industry was formerly an important segment of the wood-turning industry. This industry reached its heyday when New England was the center of the textile

Wood products from New Hampshire: wire-cable reels awaiting shipment.

UNIV. N.H. COOPERATIVE EXTENSION SERVICE PHOTO industry. After World War II, the textile industry moved south, and larger, faster textile machinery was developed that lessened the demand for bobbins. Thus both total bobbin production and the number of bobbin mills declined drastically. However, as yet there is no suitable substitute for the wooden bobbin made of birch or hard maple. This means that the bobbin industry will probably continue to be represented among the State's wood-based industries.

It is difficult to determine exactly how much material was consumed by the wood-turning industry. The reason for this is that most of the wood they use is harvested along with sawlogs and pulpwood and then is segregated out on the basis of its suitability for turnery bolts *(Kingsley 1973)*.

Excelsior.—The excelsior industry was once important in New Hampshire. In 1972, only one excelsior plant remained in the State. Excelsior (shredded wood, usually aspen) was once a popular padding material for shipping containers. The development of styrofoam padding has contributed much to the demise of this industry.

Other products.—New Hampshire now has only one producer of watertight white pine barrels. This industry was once an important supplier of barrels and kegs for shipping fish, butter, gunpowder, and anything else that required a watertight container. The remaining plant has recently been revitalized by turning to the manufacture of novelty cooperage products such as cigar kegs, ice buckets, and flower planters. In 1972 this 102-year-old plant produced 1,250 barrels and pails per day.

A newly developed industry in New Hampshire manufactures prefabricated log cabins. This industry has gained impetus from the development of the vacation-home business. Another somewhat similar industry produces rustic fencing; this industry uses mostly northern white-cedar logs and poles.

Fuelwood.—In 1972 New Hampshire produced 29,593 cords of fuelwood, nearly 19 thousand cords of which was roundwood. The remainder was residue from other industries. Most of the fuelwood produced—80 percent—and all of the roundwood, was hardwood. Little fuelwood is produced from growing stock. The majority comes from such sources as land-clearing, tops, limbs, shadetree removals, and sawmill slabs and edgings.

Nontimber Benefits of Forests

Though this report is concerned primarily with the growth and inventory of timber for timber products, the forests of the State provide many more goods and services. Many of these, however, never enter the market place; yet the quality of life in New Hampshire and for that matter most of New England is enriched by them.

Water

New Hampshire contains all or parts of the headwaters of four major New England rivers —the Connecticut, Merrimack, Piscataqua, and Androscoggin. If the mountains of New Hampshire were not heavily forested, the major population centers downstream could expect periodic severe floods. In an average year, New Hampshire receives between 40 and 45 inches of precipitation, about half in the form of snow. Because the forest floor acts like a giant sponge to absorb this moisture and prevent excessive runoff, the differences between peak and low flows of New England's rivers are much less than they would otherwise be. Despite the forests, however, severe floods have occasionally occurred, particularly on the lower Connecticut and Merrimack Rivers. However, the addition of a few strategically located dams has substantially reduced the risk of catastrophic floods.

New Hampshire is well known for its many clear streams and lakes. It is the forest that is largely responsible for keeping them that way by controlling excessive runoff and sedimentation.

Recreation

The forest setting greatly enhances outdoor recreation in New Hampshire. Outdoor recreation—be it skiing, camping, fishing, hunting, hiking, or just plain sightseeing—has become a big business. Each year millions of people spend hundreds of millions of dollars for outdoor recreation in New Hampshire.

DICK SMITH PHOTO

shing in the Swift River. Few states have as many lakes, nds, and streams of clear water as New Hampshire has.

In 1974, an estimated 3,816,097 people visited facilities operated by the New Hampshire Department of Resources and Economic Development, Division of Parks. These facilities include state parks, historic sites, ski areas, and public beaches.

There are more than 275 camping areas with a total of nearly 16,000 campsites in New Hampshire. These range from primitive areas for back-packers to highly developed sites with all the comforts of home. More than 5.5 million camper-days were spent in these 16,000 campsites in 1974. (A camper-day is any day or part of a day spent by a person while camping.) The State maintains 13 camping areas with a total of 923 campsites, and the White Mountain National Forest maintains 18 areas with 778 sites. The other sites are in privately-owned camp grounds. This industry had a phenomenal rate of growth during the late 1950s and early 60s, but has now, apparently, reached the more mature stage at which growth is much slower and the cost-price squeeze of intense competition has increased the failure rate.

New Hampshire and its sister state, Vermont, are usually credited with providing the best skiing east of the Rockies and west of the Alps. During the 1974-75 ski season an estimated 2.4 million skier-days were spent by skiing enthusiasts at the 24 developed ski areas in the State. At the two state parks where there are ski areas, nearly 200,000 skier days were recorded; and receipts totaled over $1.1 million.

Hunting and fishing are also important pastime pursuits in New Hampshire. In 1974, New Hampshire sold 197,656 hunting and fishing licenses: 43,745 hunting licenses, 114,454 fishing licenses and 39,457 combination hunting and fishing licenses. In recent years hunters have spent an average of $31,481,430 annually. This is $18.28 for each of the 1,721,682 days spent in the field. Fishermen spend an average of $51,006,574 annually or $14.40 per day for 3,543,149 days. During the 1974 big-game season in New Hampshire, hunters shot 269 black bear and 6,917 white tailed deer. These two big-game species depend on a forest environment for food and shelter.

Wildlife

Because the forested lands of New Hampshire contain a great variety of forest site conditions, stand-sizes, and forest types, they provide habitat for a vast array of fauna and flora. In addition to game species like ruffed grouse, cottontail rabbits, varying hare, white tailed deer, and black bear, they host such species as the bald eagle, otter, moose, and bobcat. The State also porvides habitats for a number of the more spectacular songbirds like the indigo bunting, pine grosbeak, scarlet tanager, and cedar waxwing.

This varied habitat also provides many ecological niches for a large variety of herbaceous and woody plants. Rich soils under dense mature white pine stands support colonies of bluets, checkerberry, and trailing arbutus. Edges provide sites for serviceberry, and banks provide sites for hepatica or sumac.

There are close inter-relationships between plants and animals. Various cover types provide food and shelter and mating and rearing areas for wild animals. In turn animals help, through their feeding habits primarily, to disperse seeds of many species and to control competitive plant species. Often the inter-

N.H. DEPT. OF FISH & GAME PHOTOS

New Hampshire forests provide habitat for a great variety of wildlife—a black bear cub, a white-tailed deer fawn, and the nest of a ruffed grouse.

relationship may be so specific that elimination or substantial reduction in numbers of a single species of plant or animal may increase or decrease the numbers of another species.

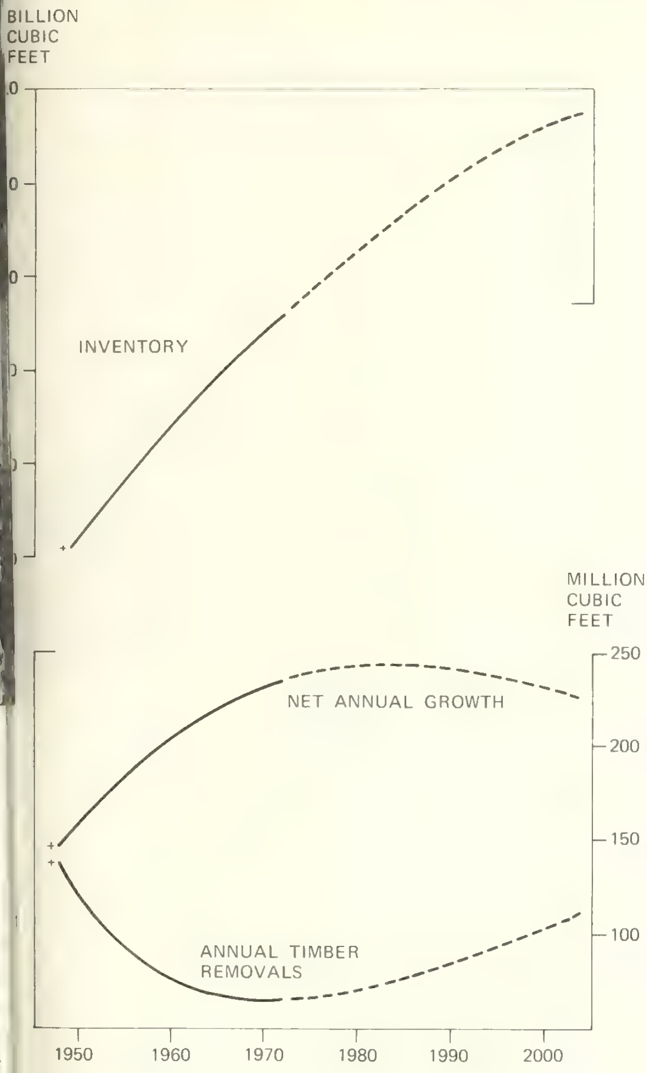
It is this varied forest cover, with its delicate mixture of life forms, that in large measure gives New Hampshire its appeal to tourists, sightseers, backpackers, skiers, and outdoor enthusiasts of all kinds. Other areas have mountains, lakes, snow, and trees; but in very few places in the world do they come together as they do in New Hampshire.

Timber Supply Outlook

The results of this forest survey of New Hampshire show that the total net annual growth of growing stock rose from 148.6 million cubic feet in 1948 to 236.3 million cubic feet in 1972. During this same period, annual timber removals dropped from 132 million cubic feet to 64.4 million cubic feet. This resulted in an increase in the growing stock of 51 percent. In 1948 the total growing-stock inventory stood at 4.1 billion cubic feet, and by 1973 it had reached nearly 6.6 million. During this same 25-year period, the commercial forest land area of the State at first increased, but it began to decline slowly during the 1960s. By 1973 the total commercial forest land area of the State stood at about the same level as in 1948—4.7 million acres.

With these past trends as prologue, we now confront the question of what might be expected to happen during the coming 30 years. In addition to the usual factors that make long-run projections risky, such as depressions and wars, the present economic and environmental situations further compound the prob-

Figure 13.—Projected growing-stock inventory, growth, and removals in New Hampshire to 2003.



lem. Will wood become an important source of fuel, replacing fossil fuels to some extent? Have petrochemical-based plastics and synthetic fibers had their day? If so, will this mean a return to the use of paper and wood? Will New Hampshire become even more of a mecca for those people who wish "to get away from it all"?

The answer to all these questions is a qualified Yes. Given the apparent plight of the world's supply of fossil fuels, the long-term trend must be both away from their consumption and toward more efficient and less harmful use of what is consumed. And wood, because it is both abundant and renewable, seems to be a logical alternative source of energy.

Over the long run, New Hampshire will probably become more of a haven for recreationists as affluence increases and more leisure time becomes available. This will probably mean that more commercial forest land will be removed from timber production, either formally through governmental edicts or administrative decisions, or informally, through landowner attitudes that preclude timber production.

Since both of the above considerations tend to be somewhat counterbalancing, what might the future supply of timber be in New Hampshire in the coming years? In this projection it is assumed that the area of commercial forest land will continue to decline gradually over the next 30 years for a total loss of nearly 500,000 acres. All indications are that timber removals reached their nadir in 1972. Pulpwood production was up in 1973 and again in 1974. Much of the recent decline in timber removals has been the result of restructuring in the major wood-using industries in the region, and indications are that removals will show a gradual upswing as the industry develops to fully utilize available growth.

The rate of increase in timber removals is not expected to affect the increase in net annual growth (fig. 13). Consequently, the total inventory of growing stock is expected to increase over the period. Over the projection period, the average volume of growing stock per acre of commercial forest land in New Hampshire is expected to increase from the present 1,402 cubic feet to 2,072 cubic feet in the year 2003. This means that growth per acre will increase from the present average of about 50 cubic feet per acre to a maximum of 54 cubic feet about 1990 and then hold constant for the next 12 years.

The reason why net annual growth is not expected to increase beyond 54 cubic feet is twofold. First, it is assumed that the level of forest management will not be significantly increased statewide by 1990. Second, about 1990 the optimum level of stocking will have been reached, and any further increase in stocking will not affect a consequent increase in growth per acre. This fact, coupled with the expected decrease in the acreage of commercial forest land, is reflected in both the total net annual growth curve and the total inventory curve. Thus, total net annual growth will continue to increase, but at a decreasing rate, to a maximum of about 245 million cubic feet in 1983 and then decline to 230 by 2003. Similarly, the total inventory will also increase, but at a slightly decreasing rate. Total inventory will rise from 6.6 billion cubic feet in 1973 to 8.7 billion in 2003.

Opportunities for Forest Management

A cursory examination of the results of this third forest survey of New Hampshire would indicate that the forests of the State are in relatively good condition. Growing-stock volume per acre is nearly optimum. The distribution of stand-size classes is perhaps a little beyond what most foresters would consider optimum. Sawtimber-size stands account for more than 41 percent of the commercial forest land, poletimber size 33 percent, and sapling-and-seedling stands and nonstocked areas 25 percent. The relatively higher proportion of stands in the sawtimber-size class is largely the result of reduced timber-harvesting.

Closer examination of the results of this survey reveal several problems. Foremost among these is the changing species mix in the State. The high-value species such as sugar maple, yellow birch, and white birch have not increased in volume as greatly as have the lower valued species like red maple and northern red oak. The major reason for this is that timber markets, and therefore timber-harvesting practices, have favored the removal of high-value species while less desirable species have been left to grow and occupy space.

Another continuing problem is timber quality. Of all hardwood trees over 5 inches dbh, 22 percent are either too rough or too rotten to be considered as growing-stock trees. When we look at sawlog quality, we find that 71 percent of the hardwood sawlog volume in the State is in standard lumber log-grade-3 or poorer.

The softwood quality picture looks substantially better, until one takes into account that, for most softwood species in the State, quality is not as important a consideration as for hardwoods. But the one softwood species for which quality is a major consideration, white pine, presents a dismal picture. Only 1 percent of the white pine sawtimber volume in New Hampshire is in grade-1 logs, and 89 percent is in grade-3 or poorer logs.

At this point the reader may be tempted to ask: "Why be concerned about forest management? Hasn't timber demand been low, and isn't it expected to remain less than growth for the next 30 years?" Though this is true, it should be kept in mind that one factor contributing to the lower levels of timber harvesting has been the declining quality and productivity of the resource. All indications point to a substantially increased worldwide demand for timber. New Hampshire, with its nearly 5 million acres of forest land, will be expected to help meet these increased demands. Because timber-growing is a long-term venture, work should begin now on producing a greater supply of timber.

Many stands in New Hampshire have been harvested repeatedly by a type of timber harvesting in which only the most marketable trees were removed, and little if any thought was given to the composition or condition of future timber stands. It is primarily this practice that is responsible for the poor quality of today's stands. To realize the full productive potential of timber stands, and also to maintain a healthy forest, timber stands must be managed.

The results of the forest survey show that New Hampshire's forest resources cannot be described easily in broad terms. Different stand conditions, ownership objectives, timber markets, and many other factors dictate the management needs of individual stands or tracts of forest land. Therefore forest management is best carried out on a tract-by-tract basis by professional foresters. For these reasons we must consider the management of New Hamphire's three most important forest types—white pine, northern hardwoods, and spruce-fir separately.

Management of Eastern White Pine

The worst enemy of white pine in New Hampshire is the white-pine weevil *Pissodes strobi* (Peck). This insect attacks and kills the terminal shoot of the tree. Though this injury almost never kills the tree, it does cause excessive sweep and crook, as lateral branches compete for the position formerly held by the terminal shoot or leader. The rapidity with which one lateral shoot asserts dominance over the others determines the degree of the crook. In some cases two laterals compete long enough to establish a forked tree. In addition to causing crook, weevil injury also causes a loss in stem length, affecting 2 or 3 years of growth. Lumber defects caused by weevil injury are cross-grain, large branch knots, and loose knots. Weevil injury generally reduces board quality by one grade and occasionally by as much as three grades. In addition, weevil injuries often provide an infection court for red rot.

There are several ways to minimize weevil damage, but no practical way to eliminate it entirely. Chemical spraying can be used, but this is very expensive because it must be applied repeatedly from the ground. A silvicultural system that includes one or more of the following prescriptions seems to be the best compromise between effectiveness and economy:

- Because the weevil is attracted most to leaders that are exposed to open sunlight, white pines less than 20 feet tall should be kept shaded beneath an overstory of hardwoods.
- Maintain high density in young pine stands. This does not reduce the incidence of weevil damage, but those trees that are weeviled tend to straighten out more rapidly, and the effect of the injury is minimized.
- Intermix pine with other species, particularly hardwoods. This helps to reduce large extensive areas of pine that might permit the buildup of heavy weevil infestations. Also, such interspersion adds a shading effect.

Another problem in white pine management is the persistence of dead branches. Because of this characteristic, any program of management to produce high-quality white pine must include a program of pruning. Frequent pruning keeps knots small and helps to upgrade the lumber yield.

UNIV. N.H. COOPERATIVE EXTENSION SERVICE PHOTO

Production of quality white pine sawlogs requires frequent pruning.

Because production of quality white pine can be an expensive and time-consuming job, the forest manager should select only the better sites and manage these intensively for quality production rather than attempt less than full treatment of all the stands available to him.

Spruce/Fir Management

Successful regeneration is the principal management problem of this type. Although the type is amenable to nearly all regeneration systems, the choice of the proper regeneration system to fit a particular set of circumstances is critical *(Gibbs 1973)* because of the type's susceptibility to windthrow.

One silvicultural system that is increasingly used, and often misunderstood, is clearcutting. This system is best applied to even-aged mature or overmature stands where windthrow of residual trees would be a problem. Generally, clearcut areas should be in strips or small patches to provide shade for advance reproduction and a source of seed from the adjacent stand *(Frank and Bjorkbom 1973)*. Such clearcut patches benefit wildlife by providing openings and edges for food, cover, and browse. Large clearcut areas frequently produce soil-surface temperatures that are too high for successful germination of spruce and fir seed.

In recent years there has been considerable public controversy about use of this system. There can be no denying that a recently clearcut area looks bad. However, it is just such exposure of the mineral soil that is essential to successful seed germination of the major species in this type. When this system is properly applied, seeds will germinate without an inhibiting overstory, accumulated brush, or erosion.

In the past some public criticism of this regeneration system has been justified. Too often exploitive harvesting has masqueraded as clearcutting. In these instances clearcut areas were too large or on steep slopes, or too much logging debris was left in the area for effective regeneration. On some areas only the desired species were harvested, leaving less desirable trees to grow and develop into an overstory that inhibited the development of the new stand and dominated the site. Properly applied, silvicultural clearcutting requires that all stems of whatever species over 2 inches in diameter be removed in order that these stems do not dominate the site *(Frank and Bjorkbom 1973)*.

The selection system of silviculture, used to develop or maintain an uneven-aged forest, includes some form of periodic harvests. With this system it is very important to plan periodic harvests to assure a desirable mix of ages and diameter classes. The selection system may take the form of single-tree selection or group selection, sometimes called patch cutting. The diameter-limit system of harvesting, in which only trees over a specified diameter are removed, is a modified form of selection harvesting. A drawback to this system is that too strict an adherence to the diameter limit may result in a residual stand in which too few stems are removed in some areas while too many are removed in others.

In the shelterwood system two cuttings are undertaken to remove the harvestable stand. With this system, up to half of the basal area of the stand can be removed in the initial harvest. The residual stand provides a source of seed for the new stand, as well as partial shade and protection for the young stand underneath. The shelterwood system should not be used where windthrow is a problem.

Northern Hardwood Management

No other major forest type in New Hampshire has been subjected to such a lack of proper forest management as has this type. There are several reasons for this. Because the type is composed of a vast array of species, some of which are highly valued and others of little value commercially, many stands have been high-graded repeatedly. This means that only the marketable stems have been harvested, while those of poor quality or undesirable species are left to grow. It is this practice that is in large part responsible for the conversion of many maple/beech/birch stands to elm/ash/red maple.

Because few hard and fast rules apply to the management of this type, in approaching the management of northern hardwood stands the professional forester must call up considerable judgment and expertise. He must consider, in addition to the owner's objectives, the condition and species composition of the present stand, the browse pressure of the indigenous deer herd, the size of the trees, the age of the stand, and the site. All these factors will play important roles in choosing which silvicultural treatments to apply.

Should he desire to perpetuate such shade-tolerant species as sugar maple, beech, hemlock, or red spruce, the forester may choose the selection system *(Filip and Leak 1973)*. This is also a desirable system in which recreation, esthetics, or overbrowsing by deer may be considerations. It is important that the resulting stand be given several cuts in order to develop the desired distribution of ages, species, and sizes.

Wherever intermediate or light demanding species are desired, some form of even-aged silviculture—either clearcutting or a shelterwood system—will be chosen *(Filip and Leak 1973)*. Where white birch or yellow birch is desired, it is often necessary to clearcut and scarify the seedbed to assure successful germination of seed. The need of harvesting systems that would scarify the seedbed has played a significant role in the decrease of yellow birch in many areas of the State.

Stands that are heavily diseased should be clearcut and regenerated. Conversely, in areas with high deer populations, excessive browsing can damage or even eliminate reproduction entirely in clearcut areas.

Forest Protection

An essential function of forest management is to protect the forest from its three natural enemies: fire, insects, and disease. Because these enemies don't respect property lines, the major effort of combating them is a governmental responsibility.

Although the incidence of fires in New Hampshire has not declined in recent decades, the area burned annually has been reduced substantially. In 1972, there were 431 forest fires in the State. Of these, 377 burned less than ¼ acre, and only one burned more than 100 acres. This is the result of quick and effective fire suppression. Of the fires 1971-72, only 2 percent were caused by lightning; the other 98 percent were man-caused. Smoking and children accounted for 45 percent. These facts attest to the need for a constant public education campaign *(N.H. Dep. Resour. and Econ. Dev. 1973)*.

Several insects are factors to be dealt with in the management of New Hampshire forests. The white-pine weevil has been discussed earlier as a major factor in white pine management. Other insects include the sugar maple borer *Glycobius speciosus* (Say). This insect breeds in the tissues of fresh wounds on maples. The gypsy moth Porthetria dispar (L), which has been causing extensive damage in other states, is on the decline in New Hampshire.

Among the important diseases, perhaps the most important is white pine blister rust *Cronartium ribicola* (Fisch). Another is beech bark disease. This is not caused by a single organism but by a complex of fungi and insects. The principal culprits are the fungus *Nectria coccinea* var. *faginata* Loh., Wats., and Ay and several other fungi. The fungi enter the bark through small eruptions made by the scale insects *Cryptococcus fagi* Baer and *Xylococculus betulae* (Perg.) Morris. This complex is eventually lethal.

Air pollution is becoming increasingly a problem for white pine. Experts believe that high concentrations of ozone in the ambient air cause needle blight, emergence tip burn, or needle tissue blight.

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Appendix

I
DEFINITION OF TERMS

Land Area Classes

Land area.—(a) Bureau of the Census: the area of dry land and land that is temporarily or partly covered by water, such as marshes, swamps, and river flood plains; streams, sloughs, estuaries, and canals that are less than 1/8 statute mile in width; and lakes, reservoirs, and ponds that are less than 40 acres in area. (b) Forest Survey: the same as the Bureau of the Census, except that the minimum width of streams, etc., is 120 feet, and the minimum size of lakes, etc., is 1 acre.

Forest land.—Land that is at least 16.7 percent stocked (contains at least 7.5 square feet of basal area) by forest trees of any size or that formerly had such tree cover and is not currently developed for nonforest use. (Forest trees are woody plants that have a well-developed stem and usually are more than 12 feet in height at maturity.) The minimum area for classification of forest land is 1 acre.

Commercial forest land.—Forest land that is producing or capable of producing crops of industrial wood (more than 20 cubic feet per acre per year) and is not withdrawn from timber utilization. (Industrial wood: all roundwood products, except fuelwood.)

Noncommercial forest land.—Forest land that is incapable of yielding timber crops because of adverse site conditions (unproductive forest land), and productive forest land that is withdrawn from commercial timber use (productive-reserved forest land).

Productive-reserved forest land.—Forest land that is sufficiently productive to qualify as commercial forest land, but is withdrawn from timber utilization through statute, administrative designation, or exclusive use for Christmas-tree production.

Unproductive forest land.—Forest land that is incapable of producing 20 cubic feet per acre per year of industrial wood under natural conditions, because of adverse site conditions.

Nonforest land.—Land that has never supported forests, and land formerly forested but now in nonforest use such as for crops, improved pasture, residential areas, and the like.

Ownership Classes

National Forest.—Federal lands that have been legally designated as National Forests or purchase units and other lands that are under the administration of the Forest Service.

Federal.—Lands (other than National Forests) that are administered by Federal agencies.

State.—Lands that are owned by the State of New Hampshire or leased to the State for 50 years or more.

County and municipal.—Lands that are owned by counties and local public agencies or municipalities or leased to them for 50 years or more.

Forest industry.—Lands that are owned by companies or individuals operating wood-using plants.

Farmer-owned.—Lands that are owned by farm operators, whether part of the farmstead or not. Excludes land leased by farm operators from nonfarm owners.

Miscellaneous private.—Privately owned lands other than forest-industry and farmer-owned lands.

Stand-size Classes

Stand.—A growth of trees (see definition under "Tree Classes") on a minimum of 1 acre of forest land that is at least 16.7 percent stocked by forest trees of any size.

Sawtimber stands.—Stands that are at least 16.7 percent stocked with growing-stock trees, with half or more of total stocking in sawtimber or poletimber trees, and in which sawtimber stocking is at least equal to poletimber stocking.

Poletimber stands.—Stands that are at least 16.7 percent stocked with growing-stock trees of which half or more of this stocking is in poletimber and/or sawtimber trees in which poletimber stocking exceeds that of sawtimber.

Sapling-seedling stands.—Stands that are at least 16.7 percent stocked with growing-stock trees of which more than half of the stocking is saplings and/or seedlings.

Nonstocked areas.—Commercial forest land that is less than 16.7 percent stocked with growing-stock trees.

Stocking Classes

Stocking.—The degree of occupancy of land by trees, measured in terms of basal area of trees in a stand compared to the basal area of trees required to utilize fully the growth potential of the land. The actual stocking at a point was evaluated against a standard of 75 square feet of basal area per acre (see definition of basal area under "Tree Measurement and Volume"). The stocking percentage for a sample plot is derived from the stocking for each of 10 points. Three categories of stocking are used:

All live trees.—These are used in the classification of forest land and forest types.

Growing-stock trees.—These are used in the classification of stand-size classes.

Desirable trees.—These are used in the classification of area-condition classes.

The degree of plot stocking is viewed as a range of values rather than single points. A fully stocked stand lies within the range of 100 to 133 percent of the basal-area standard. An overstocked stand contains more than 133 percent. The range for medium stocking is 60 to 100 percent and for poor stocking is 16.7 to 60 percent of the basal-area standard. Forest land with less than 16.7 percent of the basal-area standard is classed as nonstocked.

Tree Classes

Forest trees.—Woody plants that have well-developed stems and usually are more than 12 feet in height at maturity.

Commercial species.—Tree species that are presently or prospectively suitable for industrial wood products. Excludes species of typically small size, poor form, or inferior quality, such as hawthorn and sumac.

Growing-stock trees.—Live trees of commercial species that are classified as sawtimber, poletimber, saplings, and seedlings; that is, all live trees of commercial species except rough and rotten trees. (See definitions under "Class of timber".)

Acceptable trees.—Growing-stock trees of commercial species that meet specified standards of size and quality, but do not qualify as desirable trees.

Desirable trees.—Growing-stock trees of commercial species, (a) that have no serious quality defects that limit present or prospective use for timber products, (b) that are of relatively high vigor, and (c) that contain no pathogens that may result in death or serious deterioration before rotation age.

Rotten trees.—Live trees of commercial species that do not contain at least one 12-foot sawlog or two noncontiguous sawlogs, each 8 feet or longer, now or prospectively, and do not meet regional specifications for freedom from defect primarily because of rot; that is, when more than 50 percent of the cull volume in a tree is rotten.

Rough trees.—(a) The same as above, except that rough trees do not meet regional specifications for freedom from defect primarily because of roughness or poor form, and (b) all live trees that are of noncommercial species.

Site-quality Classes

Site class.—A classification of forest land in terms of inherent capacity to grow crops of industrial wood. Classifications are based upon the mean annual growth of growing stock attainable in fully stocked natural stands at culmination of mean annual growth.

Forest Types

Forest type is a classification of forest land based upon the species forming a plurality of live-tree stocking. The many local forest types in New Hampshire were combined into the following major forest types:

White pine/red pine/hemlock.—Forests in which eastern white pine, red pine, or hemlock, singly or in combination, make up a plurality of the stocking. (Common associates include aspen, birch, and maple.)

Spruce/fir.—Forests in which spruce or balsam fir, singly or in combination, make up a plurality of the stocking. Cedar swamps are also in this type. (Common associates include white-cedar, tamarack, maple, birch, and hemlock.)

Pitch pine.—Forests in which pitch pine comprises a plurality of the stocking. (Common associates include oaks.)

Oak/pine.—Forests in which hardwoods (usually red or black oaks) comprise a plurality of the stocking, but in which pines comprise 25 to 30 percent of the stocking.

Oak/hickory.—Forests in which oaks, singly or in combination, make up a plurality of the stocking, except where pines make up 25 to 50 percent, in which case the stand would be classified as oak/pine. Hickory is seldom present in New Hampshire. (Common associates include elm and the maples.)

Elm/ash/red maple.—Forests in which elm, ash, or red maple, singly or in combination, comprise a plurality of the stocking. (Common associates include beech, white pine, basswood, and sugar maple.)

Maple/beech/birch.—Forests in which sugar maple, beech, or yellow birch, singly or in combination, comprises a plurality of the stocking. (Common associates include hemlock, elm, basswood, white pine, white birch and red maple.) Also called northern hardwoods.

Aspen/birch.—Forests in which aspen, balsam poplar, paper birch, or gray birch, singly or in combination, comprise a plurality of the stocking. (Common associates include red maple and balsam fir.)

Class of Timber

Softwoods.—Coniferous trees that are usually evergreen, having needles or scale-like leaves.

Hardwoods.—Dicotyledonous trees that are usually broad-leaved and deciduous.

Sawtimber trees.—Live trees of commercial species, (a) that are of the following minimum diameters at breast height—softwoods 9.0 inches and hardwoods 11.0 inches; and (b) that contain at least one 12-foot merchantable sawlog or two noncontiguous 8-foot merchantable sawlogs, and meet regional specifications for freedom from defect.

Poletimber trees.—Live trees of commercial species that meet regional specifications of soundness and form, and are at least 5.0 inches dbh but are smaller than sawtimber size.

Saplings.—Live trees of commercial species that are 1.0 to 5.0 inches in diameter at breast height and of good form and vigor.

Seedlings.—Live trees of commercial species that are less than 1.0 inch in diameter at breast height and are expected to survive.

Rough and rotten trees.—See definitions under "Tree Classes".

Timber Measurement and Volume

Basal area.—The area in square feet of the cross-section at breast height of a single tree, or of all the trees in a stand, usually expressed as square feet of basal area per acre.

Board foot.—A unit of lumber measurement 1 foot long, 1 foot wide, and 1 inch thick, or its equivalent. By forest-survey convention, softwoods less than 9.0 inches dbh and hardwoods less than 11.0 inches dbh do not contain board-foot volume.

Diameter at breast height (dbh).—The diameter outside bark of a standing tree measured at 4½ feet above the ground.

Growing-stock volume.—Net volume, in cubic feet, of live growing-stock trees that are 5.0 inches dbh and larger, from a 1-foot stump to a minimum 4.0-inch top diameter outside bark of the central stem, or to the point where the central stem breaks into limbs. Net volume equals gross volume less deduction for rot.

International ¼-inch rule.—A log rule, or formula, for estimating the board-foot volume of logs. Stated mathematically, the formula is $[\{D^2 \times 0.22\} - 0.71\ D] \times 0.904762$ for 4-foot sections, where D = the diameter inside bark at the small end of the 4-foot section. The International ¼-inch rule is used as the USDA Forest Service standard log rule in the northeastern United States.

Standard cord.—A unit of measure for stacked bolts of wood, encompassing 128 cubic feet of wood, bark, and air space. Cord estimates can be derived from cubic-foot estimates of growing stock by applying an average factor of 80 cubic feet of wood (inside bark) per rough cord.

Sawtimber volume.—Net volume in board feet, International ¼-inch rule, of merchantable sawlogs in live sawtimber trees. Net volume equals gross volume less deductions for rot, sweep, and other defects that affect use for lumber.

Sawlog.—A log that meets minimum standards of diameter, length, and defect, including logs at least 8 feet long, and with a minimum diameter inside bark of 6 inches for softwoods and 8 inches for hardwoods. (See specifications under "Log Grade Classification".)

Sawlog portion.—That part of the bole of a sawtimber tree between the stump and the sawlog top (merchantable height).

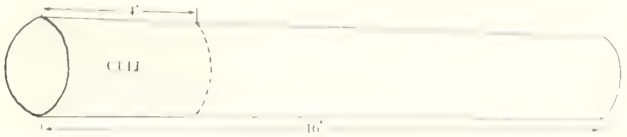
Sawlog top.—The point on the bole of a sawtimber tree above which a sawlog cannot be produced. The minimum sawlog top is 7.0 inches d.o.b. (diameter outside bark) for softwoods and 9.0 inches d.o.b. for hardwoods.

Upper-stem portion.—That part of the main stem or fork of a sawtimber tree above the sawlog top to a diameter of 4.0 inches outside bark or to the point where the main stem or fork breaks into limbs.

Log-Grade Classification

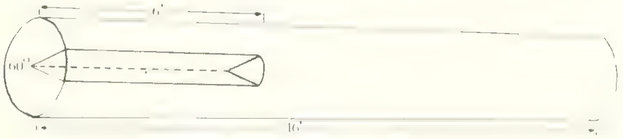
Methods of determining scaling deduction.

(Examples based on a 16-foot log with 20-inch scaling diameter)



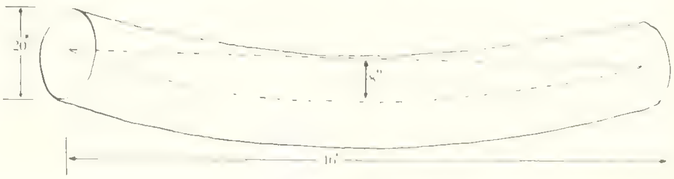
Defect section (rule 1):

Percent deduction $\frac{4}{16}$ = 25%



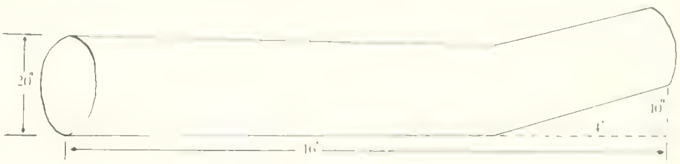
Defect section (rule 2):

Percent deduction $(\frac{6}{16})(\frac{60}{360})$ = 6 1/4



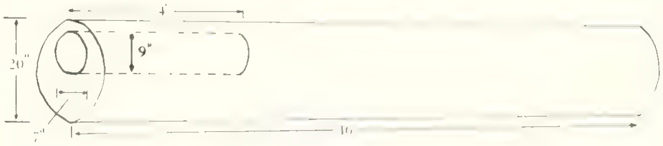
Sweep (rule 3):

Percent deduction $\frac{8-2}{20}$ = 30%



Crook (rule 4):

Percent deduction $(\frac{10}{20})(\frac{4}{16})$ = 12 1/2



Interior defect (rule 5):

Percent deduction $\frac{(8)(10)}{(20-1)^2} \times \frac{4}{16}$ = [illegible]

In practice each elipse axis can be divided by (20 − 1) and rounded to nearest tenth if desired.

Thus $\frac{8}{19}$ = .4, $\frac{10}{19}$ = .5 and (.4)(.5)$(\frac{4}{16})$ = 5%

From Grosenbaugh, L. R., SHORT-CUTS FOR CRUISERS AND SCALERS. USDA Forest Serv. South. Forest Exp. Sta., Occas. Paper 126, 1952

Log grades are a classification of logs based on external characteristics as indicators of quality or value. The log-grade standards and grading systems for softwood and hardwood species used in this forest survey of New Hampshire are shown in the following specifications.

EASTERN WHITE PINE SAWLOG GRADE SPECIFICATIONS

GRADING FACTOR	LOG GRADE 1	LOG GRADE 2	LOG GRADE 3	LOG GRADE 4
(1) MINIMUM SCALING DIAMETER (inches)	14[1]	6	6	6
(2) MINIMUM LOG LENGTH (feet)	10[2]	8	8	8
(3) MAXIMUM WEEVIL INJURY (number)	None	None	2 injuries[3]	No limit
(4) MINIMUM FACE REQUIREMENTS	Two full length or four 50% length good faces.[4] (In addition, log knots on balance of faces shall not exceed size limitations of grade 2 logs.)	No GOOD FACES REQUIRED. Maximum diameter of log knots on three best faces		Includes all logs not qualifying for No. 3 or better and judged to have at least one-third of their gross volume in sound wood suitable for manufacture into standard lumber.
		SOUND RED KNOTS not to exceed 1/6 scaling diameter and 3 inch maximum **DEAD OR BLACK KNOTS** including overgrown knots not to exceed 1/12 scaling diameter and $1\frac{1}{2}$ inch maximum	**SOUND RED KNOTS** not to exceed 1/3 scaling diameter and 5 inch maximum. **DEAD OR BLACK KNOTS** including overgrown knots not to exceed 1/6 scaling diameter and $2\frac{1}{2}$ inch maximum.	
(5) MAXIMUM SWEEP OR CROOK ALLOWANCE (percent)	20	30	40	$66\frac{2}{3}$
(6) MAXIMUM TOTAL SCALING DEDUCTION (percent)	50	50	50	$66\frac{2}{3}$

After the tentative log grade is established from face examination, the log will be reduced in grade whenever the following defects are evident:

(7) CONKS, PUNK KNOTS, AND PINE BORER DAMAGE ON BARK SURFACE[5]

Degrade one grade if present on one face.
Degrade two grades if present on two faces
Degrade three grades if present on three or more faces.

(8) LOG END DEFECTS: RED ROT, RING SHAKE, HEAVY STAIN AND PINE BORER DAMAGE OUTSIDE HEART CENTER OF LOG[5]

Consider log as having a total of 8 quarters (4 on each end) and degrade as indicated below.
Degrade one grade if present in 2 quarters of log ends
Degrade two grades if present in 3 or 4 quarters of log ends.
Degrade three grades if present in 5 or more quarters of log ends.

[1] 12 and 13 inch logs with four full length good faces are acceptable
[2] 8 foot logs with four full length good faces are acceptable
[3] 8 foot No 3 logs limited to one weevil injury
[4] Minimum 50% length good face must be at least 6 feet
[5] Factors 7 and 8 are not cumulative (total degrade based on more serious of the two) No log to be degraded below grade 4 if net scale is at least one-third gross log scale.

From: Ostrander, M. D., and R. L. Brisbin, SAWLOG GRADES FOR EASTERN WHITE PINE. USDA For. Serv. Res. Pap. NE-205, 1971.

SPRUCE, FIR, HEMLOCK, TAMARACK, AND CEDAR LOG GRADE

(Minimum merchantability specifications)

Log grade	*Minimum size*		*Defect allowance*		*Other requirements*
	Diameter[1]	*Length*[2]	*Sweep or crook*	*Total deduction*	
	Inches	*Feet*	*Percent*	*Percent*	
1	10-12	8-16 in 2-foot multiples	25	50	Sound knots not over 2 inches in diameter permitted. Shake permitted up to 20 percent of gross scale if not combined with other serious defects.
	13+	8-16 in 2-foot multiples	25	50	Sound knots not over 3 inches in diameter permitted. Shake permitted up to 20 percent of gross scale if not combined with other serious defects.

[1] At small end of log.
[2] Without trim.

Forest Service standard grades for hardwood factory lumber logs.[a]

Grading Factors		Log grades							
		F1			F2				F3
Position in tree		Butts only	Butts & uppers		Butts & uppers				Butts & uppers
Scaling diameter, inches		13-15[b]	16-19	20+	11+[c]	12+			8+
Length without trim, feet		10+			10+	8-9	10-11	12+	8+
Required clear cuttings[d] of each of 3 best faces[e]	Min. length, feet	7	5	3	3	3	3	3	2
	Max. number	2	2	2	2	2	2	3	No limit
	Min. proportion of log length required in clear cutting	5/6	5/6	5/6	2/3	3/4	2/3	2/3	1/2
Maximum sweep & crook allowance	For logs with less than ¼ of end in sound defects	15%			30%				50%
	For logs with more than ¼ of end in sound defects	10%			20%				35%
Maximum scaling deduction		40%[f]			50%[g]				50%

End defects, although not visible in standing trees, are important in grading cut logs. Instructions for dealing with this factor are contained in Forest Prod. Lab. Rpt. D 1737.

[a] From USDA Forest Service Research Paper FPL-63 (*13*).
[b] Ash and basswood butts can be 12 inches if they otherwise meet requirements for small #1's.
[c] Ten-inch logs of all species can be #2 if they otherwise meet requirements for small #1's.
[d] A clear cutting is a portion of a face, extending the width of the face, that is free of defects.
[e] A face is ¼ of the surface of the log as divided lengthwise.
[f] Otherwise #1 logs with 41-60% deductions can be # 2.
[g] Otherwise #2 logs with 51-60% deductions can be # 3.

Forest Service standard specifications for hardwood construction logs.[a]

Position in tree		Butt & upper
Min. diameter, small end		8 inches +
Min. length, without trim		8 feet
Clear cuttings		No requirements.
Sweep allowance, absolute		¼ diameter small end for each 8 feet of length.
Sound surface defects	Single knots	Any number, if no one knot has an average diameter above the callus in excess of ⅓ of log diameter at point of occurrence.
	Whorled knots	Any number if sum of knot diameters above the callus does not exceed ⅓ of log diameter at point of occurrence.
	Holes	Any number provided none has a diameter over ⅓ of log diameter at point of occurrence, and none extends over 3 inches into included timber.[b]
Unsound surface defects		Same requirements as for sound defects if they extend into included timber.[b] No limit if they do not.
End defects	Sound	No requirements.
	Unsound	None allowed; log must be sound internally, but will admit 1 shake not to exceed ¼ the scaling diameter and a longitudinal split not extending over 5 inches into the contained timber.

[a] These specifications are minimum for the class. If, from a group of logs, factory logs are selected first, thus leaving only non-factory logs from which to select construction logs, then the quality range of the construction logs so selected is limited, and the class may be considered a grade. If selection for construction logs is given first priority, then it may be necessary to subdivide the class into grades.

[b] Included timber is always square, and dimension is judged from small end.

From: Rast, E. D., D. L. Sonderman, and G. L. Gammon, A GUIDE TO HARDWOOD LOG GRADING (REVISED). USDA For. Serv. Gen. Tech. Rep. NE-1, 1973.

Annual Net Growth and Timber Removals

Average annual net growth of growing stock.—The change (resulting from natural causes) in volume of sound wood in sawtimber and poletimber trees during the period between surveys, divided by the length of the period. (Components of annual net growth of growing stock include the increment in net volume of trees present at the beginning of the period and surviving to its end, plus net volume of trees reaching poletimber size during the period, minus the net volume of trees that died during the period, minus cull increment, the net volume of trees that became rough or rotten trees during the period.)

Average annual ingrowth of growing stock.—The net cubic-foot volume of trees now classed as growing stock that were less than 5.0 inches dbh on the initial survey, divided by the length of the period between surveys.

Average annual mortality of growing stock.—The net cubic-foot volume removed from the growing stock because of death from natural causes during the period between surveys, divided by the length of the period between surveys.

Average annual growing-stock removals.—The net cubic-foot volume of growing-stock trees harvested or killed in logging, cultural operations such as timber-stand improvement, land-clearing, or changes in land use during the period between surveys, converted to an annual basis.

Average annual net growth of sawtimber.—The change (resulting from natural causes) in net board-foot volume of sawtimber during the period between surveys, divided by the length of the period. (Components of annual net growth of sawtimber include the increment in net volume of sawtimber trees present at the beginning of the period and surviving to its end, plus the net volume of trees reaching sawtimber size during the period, minus the net volume of sawtimber trees that died during the period, minus the net volume of sawtimber trees that became rough or rotten trees during the period between surveys, cull increment.)

Average annual ingrowth of sawtimber.—The net board-foot volume of trees now classed as sawtimber that were not tallied as such on the initial survey, divided by the length of the period between surveys.

Average annual mortality of sawtimber.—The net board-foot volume removed from live sawtimber by death from natural causes during the period between surveys, divided by the length of the period between surveys.

Average annual sawtimber removals.—The net board-foot volume of sawtimber trees harvested or killed in logging, cultural operations such as timber-stand improvement, land-clearing, or changes in land use during the period between surveys, converted to an annual basis.

Cull increment.—The net volume of growing-stock trees on the initial inventory that became rough or rotten trees in the subsequent inventory.

Logging residues.—The unused growing-stock volume of trees cut for products and the total growing-stock volume of trees destroyed in the course of logging but not removed for products.

Other removals.—The growing-stock volume of trees that were removed from the inventory and not used for products, by cultural operations (weeding, thinning, etc.), land-clearing, and reclassification of some commercial forest land as noncommercial forest land.

Plant byproducts.—Wood products, such as slabs, edgings, and veneer cores, that are obtained incidental to the production of timber products and are utilized in the manufacture of other timber products. (Bark is not included.)

Plant residues.—Wood material produced incidental to the production of timber products but not utilized.

Roundwood products.—Logs, bolts, or other round sections cut from growing stock or nongrowing stock for industrial or nonindustrial uses.

Timber products.—Roundwood products and plant byproducts from all sources.

Timber removals.—The growing-stock volume of trees removed from the inventory for roundwood products, plus logging residues and other removals.

Annual net growth trend-level.—The estimated growth of growing stock or sawtimber for a specific year that is consistent with the average annual growth during the period between surveys and with the current inventory. (1972 for New Hampshire.)

II

FOREST SURVEY METHODS

The Northeastern Forest Experiment Station's Forest Survey project used the sampling with partial replacement (SPR) design in the reinventory of New Hampshire's timber resource. With this design, estimates of forest area and timber volume were made by combining a subsample of remeasured plots, a regression updating of the previous inventory, and a new independent photo- and ground-plot inventory. Thus the SPR design, by combining two independent estimates of the inventory, yields a statistically more accurate estimate of the timber resource than other methods at the same cost.

Remeasurement

One estimate is based on the updating of the 1960 survey. This required the remeasurement of 218 second-inventory ground plots. A total of 91 of these were among the 909 originally measured in 1948. The remaining 127 plots were installed as part of the 1960 inventory purposely to be remeasured. With the area-change and current-volume estimates obtained from the remeasurement sample plots, regression techniques were used to update all the 1960 inventory ground and photo plots to obtain an independent estimate of current timber volume and forest area.

In addition to estimating current timber volume and forest area, the forest survey of New Hampshire was designed to obtain an estimate of the components of average annual change during the period between the initial and the current inventories. The parameters of interest include area change from forest to nonforest and vice versa, timber growth, timber removals, and timber mortality. All this information was obtained from the remeasured plots. The timber-change parameters were obtained by a tree-by-tree reconciliation of each remeasured plot. The reconciliation code for each remeasured tree was used to make estimates of the parameters of change, by species. The estimates of change were expressed as average annual figures by dividing the totals for the period by the number of years between measurements. These estimates were then used in the computations of annual net growth, mortality, and removals for 1972.

New-Ground Phase

The source of the new independent estimates of volume and forest area was a new aerial-photo stratification with a subsample of ground measurements. This photo sample of New Hampshire consisted of 15,756 points on the latest available aerial photography. A subset of 709 of these photo plots, including 114 on noforest land, was located on the ground. Land use was verified and the tree-measurement data were recorded for the 595 forested plots. Unlike the initial inventory, in which fixed-radius 1/5-acre plots were tallied, the new ground plots consisted of a cluster of 10 prism points systematically covering approximately 1 acre. At each point, trees were selected for tally by using a prism with a basal-area factor of 37.5. Area-attribute data were also tallied at each of the 10 points.

County Data

Many users of forest-survey data have shown a need for county information. To provide such information, within the framework of the survey design, tables for counties have been developed, based on a survey-unit partitioning technique.

First, the geographic stratum means and variances for the various photo-plot strata were applied to the photo-plot data for each county within the stratum. This yielded an estimate of total volume or total commercial forest-land area for each county. Next, the data from all the new ground plots in each geographic stratum were used to partition the county totals into their various components. For example, if a table of cubic-foot volume by softwoods and hardwoods is to be made for a county, the estimate of total cubic-foot volume for that county is partitioned into softwood and hardwood totals according to the proportion of softwoods and hardwoods for all new forest-survey ground plots within the geographic stratum.

Comparisons Between Inventories

After inventories have been completed for several points in time, it is desirable to evaluate the trends between the several inventories and to make comparisons. A comparison of the 1948, 1960, and 1973 forest-survey estimates of volume, growth, removals, and mortality was made for New Hampshire. A computer program, TRAS (Timber Resource Analysis System), was used.

Because of changes in procedures and in definitions, it was necessary to adjust the 1948 and 1960 inventory-volume estimates to what they would have been had the 1973 procedures and definitions been used in the 1948 and 1960 inventories. This process involved several calculations and adjustments of the 1948 and 1960 inventories in order to make them comparable with the 1973 inventory. An important step in this process was to recalculate the 1948 and 1960 inventory volume, using the average net volume per tree developed by the third inventory (1973). To do this, the average net volume per tree (for softwoods and hardwoods) developed from the third survey for each 2-inch diameter class was multiplied by the number of trees in each 2-inch diameter class from the 1948 and 1960 inventories. These calculations resulted in inventory estimates for 1948 and 1960 adjusted to 1973 standards and procedures. These adjusted estimates, not the estimates published in the reports of the earlier surveys, are the basis for comparisons between surveys shown in this report.

Data Processing

Field-tally data consisting of plot and individual-tree information were processed and compiled into various tables using FINSYS—Forest Inventory System—on modern large-capacity high-speed computers.

FINSYS is a data-processing system consisting primarily of a series of computer programs that was developed by the Northeastern Forest Experiment Station to process and compile a large volume of forest-inventory data. The system consists of an editing subsystem that edits field-tally data for errors; a table-compiling subsystem that compiles tables from edited field data; and finally, an output subsystem that expands the plot data to geographic-unit or statewide estimates and prints the final tables.

FINSYS was described in a series of research papers by R. W. Wilson and R. C. Peters in 1967: *The Northeastern Forest Inventory Data Processing System,* USDA Forest Service Research Papers NE-61 and NE-70 to 80.

Before modern computers came into use, the compiling of forest-inventory data was a major bottleneck in forest-inventory work. Using FINSYS, it is possible, as in the resurvey of New Hampshire, to have preliminary estimates available within 6 months after the last plot is taken. To process and compile data for a state the size of New Hampshire, from key-punching to the output of tables, requires about 2½ months of elapsed time and about 2½ hours of computer time.

FINSYS has several features that make it unique. One of these is the ability not only to calculate inventory estimates but also to calculate the variance and sampling error for each estimate. This feature provides the user with a measure of the reliability of each statistic and the ability to determine the reliability of a new estimate based upon any data combination he may make.

Another feature of FINSYS is its flexibility. The system is not restricted to the Northeastern forest survey but can be used for any large-scale forest inventory. Also, the system does not produce a standard set of tables. The individual user specifies the tables to be developed according to his particular need. Thus at any stage in the data-processing phase or even at a later date, a specific table can be developed with minimum effort.

III
RELIABILITY OF THE ESTIMATES

The forest-area and timber-volume data presented in this report were based upon a carefully designed sample of forest conditions throughout New Hampshire. However, since neither every acre nor every tree in the State was measured, the data presented in this report are estimates. A measure of the reliability of these estimates is given by a sampling error. An associated sampling error was calculated for each estimate in this report. Many of these appear in the data tables.

Briefly, this is how the sampling error indicates the reliability of an estimate. The estimate of the total growing-stock volume in New Hampshire—6,579 million cubic feet—has an associated sampling error of 2 percent (132 million cubic feet). This means that the best estimate of the total growing-stock volume in New Hampshire in 1973 is 6,579 million cubic feet. If there are no errors in procedure, the odds are 2 to 1 that, if we repeated the survey in the same way, the resulting estimate of growing-stock volume would be between 6,447 million and 6,711 million cubic feet (6,579 ±132). Similarly, the odds are 19 to 1 that it would be within ±264 million cubic feet and 300 to 1 that it would be within ±396 million cubic feet.

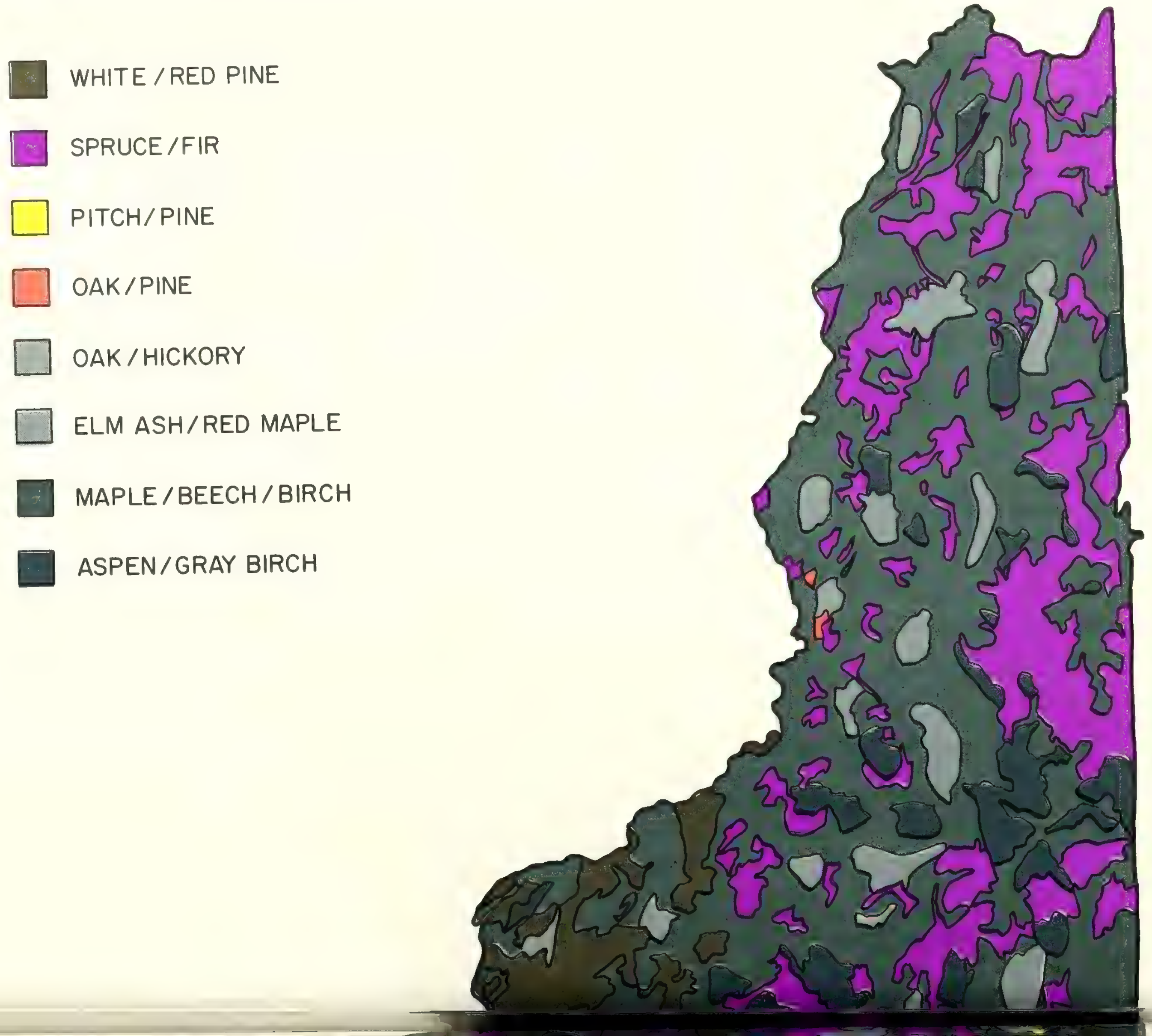
The computed sampling error is not a complete measure of reliability. There are other sources of error that this term does not include. There could be imperfections in volume tables and equations, and errors in field measurement. Procedural errors were kept to a minimum by careful training of all personnel, frequent inspection of field work, and application of the most reliable survey methods.

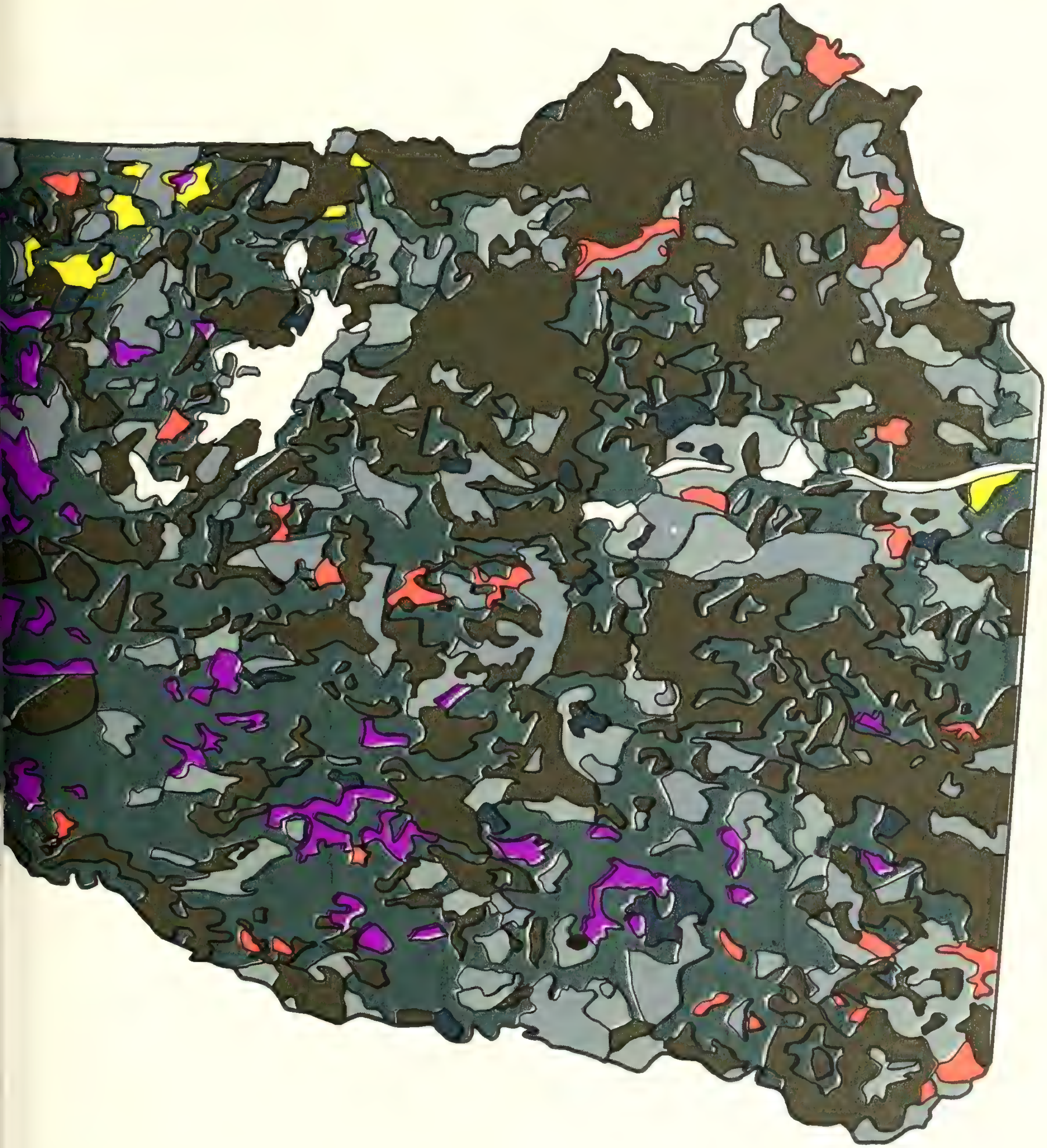
IV
COMMERCIAL TREE SPECIES OF NEW HAMPSHIRE

Occurrence[1]	*Common Name*	*Scientific Name*[2]
	Softwoods	
vc	Balsam fir	*Abies balsamea*
vr	Atlantic white-cedar	*Chamaecyparis thyoides*
c	Eastern redcedar (savin)[3]	*Juniperus virginiana*
r	Tamarack (larch, hackmatack)	*Larix laricina*
r	Norway spruce[4]	*Picea abies*
c	White spruce	*P. glauca*
r	Black spruce	*P. mariana*
vc	Red spruce	*P. rubens*
vr	Jack pine	*Pinus banksiana*
c	Red pine (Norway)	*P. resinosa*
r	Pitch pine	*P. rigida*
vc	Eastern white pine	*P. strobus*
r	Scotch pine[4]	*P. sylvestris*
vr	Douglas-fir[4]	*Psuedotsuga menziesii*
r	Northern white-cedar	*Thuja occidentalis*
vc	Eastern hemlock	*Tsuga canadensis*
	Hardwoods	
vc	Red maple	*Acer rubrum*
vr	Silver maple	*A. saccharinum*
vc	Sugar maple	*A. saccharum*
vc	Yellow birch	*Betula alleghaniensis*
c	Sweet birch (black)	*B. Lenta*
vc	Paper birch (white)	*B. papyrifera*
r	American hornbeam (blue beech)	*Carpinus caroliniana*
r	Hickory	*Carya species*
r	American chestnut	*Castanea dentata*
r	Flowering dogwood	*Cornus florida*
vc	American beech	*Fagus grandifolia*
c	White ash	*Fraxinus americana*

CONTINUED

THE MAJOR FOREST TYPES OF NEW HAMPSHIRE





Occurrence[1]	*Common Name*	*Scientific Name*[2]
vr	Black ash (brown)	*F. nigra*
vr	Green ash (red)	*F. pennsylvanica*
r	Butternut	*Juglans cinerea*
vr	Black tupelo (blackgum)	*Nyssa sylvatica*
c	Eastern hophornbeam (ironwood)	*Ostrya virginiana*
vr	American sycamore (buttonwood)	*Platanus occidentalis*
r	Balsam poplar (balm-of-Gilead)	*Populus balsamifera*
vr	Eastern cottonwood	*P. deltoides*
c	Bigtooth aspen (popple)	*P. grandidentata*
c	Quaking aspen (popple)	*P. tremuloides*
c	Black cherry	*Prunus serotina*
c	White oak	*Quercus alba*
vr	Swamp white oak	*Q. bicolor*
r	Scarlet oak	*Q. coccinea*
vr	Pin oak	*Q. palustris*
r	Chestnut oak	*Q. prinus*
vc	Northern red oak	*Q. rubra*
c	Black oak	*Q. velutina*
r	Black willow	*Salix nigra*
r	American basswood	*Tilia americana*
c	American elm (white)	*Ulmus americana*
r	Slippery elm	*U. rubra*

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[1] Occurrence is based on the frequency at which the species was encountered on forest-survey field plots: vr = very rare, r = rare, c = common, and vc = very common.

[2] Names according to: Little, Elbert L., Jr. *Checklist of Native and Naturalized Trees of the United States (including Alaska).* U. S. Dep. Agric. Handb.. 41. 472 p., 1953.

[3] Names in parentheses are other frequently used common names.

[4] Species introduced in New Hampshire.

V
INDEX TO TABLES

Statistical Tables for the State

Table No.

FOREST LAND

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Table 1.—Area by land classes, New Hampshire, 1973

Land class	Area	
	Thousand acres	*Percent*
Forest land:		
Commercial	4,692.0	81
Productive-reserved	48.7	1
Christmas-tree plantation	6.6	([a])
Unproductive	237.8	4
Total forest land	4,985.1	86
Nonforest:		
Cropland[b]	142.4	2
Pasture[b]	37.7	1
Other[c]	615.9	11
Total nonforest land	796.0	14
Total area[d]	5,781.1	100

[a] Less than 0.5 percent.

[b] Source: 1969 and 1964 Census of Agriculture. Total cropland includes cropland used for pasture. Pasture total based upon ratios developed from the 1964 census report. Data extrapolated to 1973.

[c] Includes swampland, industrial and urban areas, other nonforest land, and 46,694 acres classed as water by Forest Survey standards but defined by the Bureau of the Census as land.

[d] Source: United States Bureau of the Census, Areas of New Hampshire: 1960 (December 1966).

Table 2.—Area of commercial forest land, by ownership classes, New Hampshire, 1973

Ownership	Area[a]	
	Thousand acres	*Percent*
National Forest[b]	489.2	10
Other federal	12.6	([c])
State	79.2	2
County and municipal	28.9	1
Total public	609.9	13
Forest industry	946.9	20
Farmer owned:		
Individual	175.6	4
Corporate	8.0	([c])
Other	31.8	1
Total farmer owned	215.4	5
Miscellaneous private:		
Individual	2,283.2	49
Corporate	286.5	6
Other[d]	350.1	7
Total misc. private	2,919.8	62
All ownerships	4,692.0	100

[a] Estimates of area in each private ownership class are based upon forest-land ownership study by the Northeastern Forest Experiment Station.

[b] White Mountain National Forest, excluding 37,600 acres in Oxford County, Maine.

[c] Less than 0.5 percent.

[d] Includes acreage owned by business partnerships and organizations such as churches, Boy Scouts of America, and associations.

Table 3.—Area of commercial forest land, by stand-size and ownership classes, New Hampshire, 1973

[In thousands of acres]

Stand-size class	All ownerships	National Forest	Other public	Forest industry	Farmer and other
Sawtimber stands	1,946.2	182.6	58.7	362.0	1,342.9
Poletimber stands	1,555.6	279.2	39.4	383.2	853.8
Sapling-seedling stands	1,155.0	27.4	22.6	201.7	903.3
Nonstocked areas	35.2	—	—	—	35.2
All classes	4,692.0	489.2	120.7	946.9	3,135.2

Table 4.—Area of commercial forest land, by stand-volume and ownership classes, New Hampshire, 1973

[In thousands of acres]

Stand-volume per acre (board feet)[a]	All ownerships	National Forest	Other public	Forest industry	Farmer and other
Less than 1,500	1,422.5	102.7	28.5	292.1	999.2
1,500 to 5,000	2,358.7	249.5	68.3	544.6	1,496.3
More than 5,000	910.8	137.0	23.9	110.2	639.7
All classes	4,692.0	489.2	120.7	946.9	3,135.2

[a] International ¼-inch rule.

Table 5.—Area of commercial forest land, by stocking classes based on selected stand components, New Hampshire, 1973

[In thousands of acres]

Stocking class[a] (percent)	Stocking classified in terms of—				
	All trees	Growing-stock trees			Rough and rotten trees
		Total	Desirable	Acceptable	
Overstocked:					
160	26.5	—	—	—	—
150 to 160	310.6	29.5	—	14.7	—
140 to 150	815.8	112.8	—	72.0	—
130 to 140	1,223.4	240.6	—	182.2	7.1
Total	2,376.3	382.9	—	268.9	7.1
Fully stocked:					
120 to 130	1,102.1	592.7	—	432.7	—
110 to 120	660.4	829.5	—	782.8	14.2
100 to 110	252.1	729.8	—	786.4	14.2
Total	2,014.6	2,152.0	—	2,001.9	28.4
Medium stocked:					
90 to 100	118.4	796.7	—	734.7	28.8
80 to 90	65.0	480.6	—	627.9	14.3
70 to 80	47.4	330.9	—	398.3	121.0
60 to 70	19.3	218.4	—	310.2	170.8
Total	250.1	1,826.6	—	2,071.1	334.9
Poorly stocked:					
50 to 60	11.5	96.0	4.9	86.5	218.7
40 to 50	13.6	88.6	7.2	112.8	479.6
30 to 40	12.0	57.0	58.8	57.0	728.4
20 to 30	13.9	53.7	161.0	58.6	1,117.3
10 to 20	—	7.1	531.2	7.1	1,062.3
Less than 10	—	28.1	3,928.9	28.1	715.3
Total	51.0	330.5	4,692.0	350.1	4,321.6
All classes	4,692.0	4,692.0	4,692.0	4,692.0	4,692.0

[a] Fully stocked stands are considered to contain 75 to 100 square feet of basal area per acre.

Table 6.—Area of commercial forest land, by area-condition and ownership classes, New Hampshire, 1973

[In thousands of acres]

Area-condition class[a]	All ownerships	National Forest	Other public	Forest industry	Farmer and other
Class *10-40*	—	—	—	—	—
Class *50*	2,260.7	117.4	57.1	452.2	1,634.0
Class *60*	2,067.9	313.1	52.8	403.0	1,299.0
Class *70*	363.4	58.7	10.8	91.7	202.2
All classes	4,692.0	489.2	120.7	946.9	3,135.2

[a] Class *10-40*.—Areas medium to fully stocked with desirable trees.
Class *50*.—Areas poorly stocked with desirable trees, but fully stocked with growing-stock trees.
Class *60*.—Areas poorly stocked with desirable trees, but with medium to full stocking of growing-stock trees..
Class *70*.—Areas poorly stocked with desirable trees, and poorly stocked with growing-stock trees.

Table 7.—Area of commercial forest land, by potential site productivity and ownership classes, New Hampshire, 1973

[In thousands of acres]

Growth-per-acre class (cubic feet)	All ownerships	National Forest	Other public	Forest industry	Farmer and other
120 to 165	450.5	7.3	11.1	120.6	311.5
85 to 120	1,175.9	99.3	12.2	361.2	703.2
50 to 85	1,742.5	152.2	39.5	302.8	1,248.0
Less than 50	1,323.1	230.4	57.9	162.3	872.5
All classes	4,692.0	489.2	120.7	946.9	3,135.2

Table 8.—Area of commercial forest land, by forest types and ownership classes, New Hampshire, 1973

[In thousands of acres]

Forest type	All ownerships	National Forest	Other public	Forest industry	Farmer and other
White and red pine	1,344.6	—	39.4	41.2	1,264.0
Spruce/fir	635.9	93.8[a]	—	390.6	151.5
Pitch pine	35.8	—	—	—	35.8
Oak/pine	72.7	—	12.2	—	60.5
Oak/hickory	322.9	—	5.6	10.1	307.2
Elm/ash/red maple	737.6	—	11.6	60.4	665.6
Maple/beech/birch	1,308.3	360.2	40.6	414.3	493.2
Aspen/birch	234.2	35.2	11.3	30.3	157.4
All types	4,692.0	489.2	120.7	946.9	3,135.2

[a] The White Mountain National Forest recognizes a spruce-fir and a spruce-hardwood type in its management plan. The acreage of spruce-hardwood has been assigned to either spruce-fir or maple-beech-birch in this table, according to the portion of spruce to hardwood.

Table 9—Area of commercial forest land, by forest types and stand-size classes, New Hampshire, 1973

[In thousands of acres]

Forest type	All stands	Saw-timber stands	Pole-timber stands	Sapling-seedlings stands	Nonstocked areas
White and red pine	1,344.6	836.8	237.1	256.4	14.3
Spruce/fir	635.9	169.7	253.8	212.4	—
Pitch pine	35.8	14.8	—	14.3	6.7
Oak/pine	72.7	37.0	7.2	28.5	—
Oak/hickory	322.9	107.5	158.1	57.3	—
Elm/ash/red maple	737.6	164.8	287.0	278.7	7.1
Maple/beech/birch	1,308.3	580.7	527.9	192.6	7.1
Aspen/birch	234.2	34.9	84.5	114.8	—
All types	4,692.0	1,946.2	1,555.6	1,155.0	35.2

Table 10.—Area of commercial forest land by local forest types and major forest types, New Hampshire, 1973

[In thousands of acres]

Local forest type and major forest type	Forest type	
	Local	Major
White and red pine:		
Red pine	14.3	—
White pine	809.5	—
White pine/hemlock	339.4	—
Hemlock	181.4	—
Total	—	1,344.6
Spruce/fir:		
Balsam fir	405.6	—
Red spruce/balsam fir	216.1	—
Northern white-cedar	7.6	—
White spruce	6.6	—
Total	—	635.9
Pitch pine:		
Eastern red cedar	6.7	—
Pitch pine	29.1	—
Total	—	35.8
Oak/pine:		
White pine/red oak/white ash	65.6	—
Other oak-pine	7.1	—
Total	—	72.7
Oak/hickory:		
Post, black, or bear oak	7.2	—
White oak, red oak, hickory	28.7	—
White oak	21.6	—
Northern red oak	251.1	—
Mixed hardwoods	14.3	—
Total	—	322.9
Elm/ash/red maple:		
Black ash/elm/red maple	730.5	—
Willow	7.1	—
Total	—	737.6
Maple/beech/birch:		
Sugar maple/beech/yellow birch	1,294.0	—
Black cherry	14.3	—
Total	—	1,308.3
Aspen/birch:		
Aspen	125.4	—
Paper birch	108.8	—
Total	—	234.2
All types	4,692.0	4,692.0.

Table 11.—Area of noncommercial forest land, by forest types, New Hampshire, 1973

[In thousands of acres]

Forest type	All areas	Productive-reserved areas	Unproductive areas
White and red pine	13.3	13.3	—
Spruce/fir	61.8	12.1	49.7
Pitch pine	.3	.3	—
Oak/pine	.6	.6	—
Oak/hickory	2.7	2.7	—
Elm/ash/red maple	59.3	7.7	51.6
Maple/beech/birch	112.1	14.1	98.0
Aspen/birch	43.0	4.5	38.5
All types	293.1	55.3	237.8

Table 12.—Number of trees on commercial forest land by species groups, tree classes, and diameter classes, New Hampshire, 1973

[In thousands of trees]

DBH class *(inches)*	Softwoods			Hardwoods		
	Growing-stock trees	Rough and rotten trees	Total	Growing-stock trees	Rough and rotten trees	Total
Saplings:						
1.0 to 2.9	420,930	209,677	630,607	674,122	665,016	1,339,138
3.0 to 4.9	257,722	48,398	306,120	348,674	204,689	553,363
Total	678,652	258,075	936,727	1,022,796	869,705	1,892,501
Poletimber:						
5.0 to 6.9	147,169	18,301	165,470	201,685	64,355	266,040
7.0 to 8.9	83,682	7,070	90,752	116,672	26,519	143,191
9.0 to 10.9	—	—	—	68,022	13,539	81,561
Total	230,851	25,371	256,222	386,379	104,413	490,792
Small sawtimber:						
9.0 to 10.9	50,857	4,633	55,490	—	—	—
11.0 to 12.9	25,392	3,122	28,514	34,261	8,592	42,853
13.0 to 14.9	14,056	1,520	15,576	16,110	4,423	20,533
Total	90,305	9,275	99,580	50,371	13,015	63,386
Large sawtimber:						
15.0 to 16..9	7,703	1,037	8,740	6,879	2,968	9,847
17.0 to 18.9	3,581	631	4,212	3,290	1,858	5,148
19.0 to 20.9	1,723	304	2,027	1,608	1,163	2,771
21.0 to 28.9	1,873	389	2,262	1,423	1,849	3,272
29.0 and larger	282	71	353	97	365	462
Total	15,162	2,432	17,594	13,297	8,203	21,500
All classes	1,014,970	295,153	1,310,123	1,472,843	995,336	2,468,179

Table 13.—Number of growing-stock trees on commercial forest land, by species and diameter classes, New Hampshire, 1973

[In thousands of trees]

Species	All classes	Diameter class (inches at breast height)									
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
White and red pine[a]	116,925	42,408	25,236	18,606	12,166	7,924	4,984	2,552	1,287	1,549	213
Balsam fir	80,831	42,894	22,223	11,120	3,241	930	291	110	—	22	—
Spruce	73,441	38,089	20,354	9,336	3,038	1,382	796	302	109	32	3
Hemlock	61,699	22,810	14,831	11,213	6,434	3,549	1,594	617	327	258	66
Other softwoods	3,422	968	1,038	582	513	271	38	—	—	12	—
Total softwoods	336,318	147,169	83,682	50,857	25,392	14,056	7,703	3,581	1,723	1,873	282
Sugar maple	47,604	19,769	11,232	7,668	4,395	2,075	931	592	424	481	37
Red maple	127,574	61,850	35,293	17,477	7,701	3,238	1,268	359	185	198	5
Yellow birch	46,939	17,341	11,055	7,878	5,347	2,739	1,152	694	386	320	27
Paper birch	68,626	34,550	19,380	9,231	3,689	1,323	285	105	31	32	—
Beech	31,464	13,430	6,657	5,408	2,777	1,765	937	244	140	96	10
Ash	16,865	7,847	4,709	2,160	1,256	494	227	107	38	23	4
White oak	9,217	5,014	2,039	1,361	389	238	115	31	25	—	5
Northern red oak[b]	55,935	17,961	13,787	10,711	6,668	3,411	1,701	1,098	329	264	5
Black cherry	7,108	4,194	1,897	691	257	27	42	—	—	—	—
Aspen	22,358	11,139	5,951	3,556	1,154	447	111	—	—	—	—
Other hardwoods	16,357	8,590	4,672	1,881	628	353	110	60	50	9	4
Total hardwoods	450,047	201,685	116,672	68,022	34,261	16,110	6,879	3,290	1,608	1,423	97
All species	786,365	348,854	200,354	118,879	59,653	30,166	14,582	6,871	3,331	3,296	379

[a] Includes 5,767,000 red pine trees.

[b] Includes 4,359,000 black oak trees.

Table 14.—Net volume of timber on commercial forest land, by class of timber, softwoods and hardwoods, New Hampshire, 1973

[In millions of cubic feet]

Class of timber	All species	Softwoods	Hardwoods
Sawtimber trees:			
Sawlog portion	2,745.3	1,696.1	1,049.2
Upper-stem portion	495.0	225.2	269.8
All sawtimber trees	3,240.3	1,921.3	1,319.0
Poletimber trees	3,338.3	1,218.6	2,119.7
All growing-stock trees	6,578.6	3,139.9	3,438.7
Rough trees	537.0	212.6	324.4
Rotten trees	326.8	55.7	271.1
Total, all timber	7,442.4	3,408.2	4,034.2

Table 15.—Net volume of growing stock and sawtimber on commercial forest land, by ownership classes, stand-size classes, softwoods and hardwoods, New Hampshire, 1973

Ownership or stand-size class	Growing stock (million cubic feet)			Sawtimber (million board feet)[a]		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
BY OWNERSHIP CLASSES						
National Forest[b]	869.5	262.3	607.2	1,833.8	547.4	1,286.4
Other public	169.5	52.3	117.2	329.0	140.1	188.9
Forest industry	1,287.5	712.3	575.2	2,136.3	1,167.2	969.1
Farmer and other	4,252.1	2,113.0	2,139.1	8,766.5	5,770.3	2,996.2
All ownership	6,578.6	3,139.9	3,438.7	13,065.6	7,625.0	5,440.6
BY STAND-SIZE CLASSES						
Sawtimber stands	3,553.7	1,929.2	1,624.5	9,230.0	5,587.2	3,642.8
Poletimber stands	2,323.7	854.9	1,468.8	2,832.7	1,373.0	1,459.7
Sapling-seedling stands	699.1	355.3	343.8	996.6	664.8	331.8
Nonstocked areas	2.1	.5	1.6	6.3	—	6.3
All classes	6,578.6	3,139.9	3,438.7	13,065.6	7,625.0	5,440.6

[a] International ¼-inch rule.

[b] In its management plan, the National Forest calculates cubic-foot volume on the basis of the number of 100-inch bolts in the tree. Forest Survey utilization standards which calculate cubic-foot volume in random lengths to 4-inch top give approximately 18 percent greater volume.

Table 16.—Net volume of growing stock and sawtimber on commercial forest land, by forest types, and softwoods and hardwoods, New Hampshire, 1973

Forest type	Growing stock (million cubic feet)			Sawtimber (million board feet)[a]		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
White and red pine	2,151.9	1,579.2	573.7	5,095.0	4,451.4	643.6
Spruce/fir	957.4	777.5	179.9	1,459.3	1,224.5	234.8
Pitch pine	26.6	19.6	7.0	67.6	58.4	9.2
Oak/pine	101.5	26.6	74.9	227.2	79.0	148.2
Oak/hickory	469.8	79.6	390.2	795.3	187.9	607.4
Elm/ash/red maple	803.7	231.9	571.8	1,372.2	602.7	769.5
Maple/beech/birch	1,857.2	360.7	1,496.5	3,744.0	879.2	2,864.8
Aspen/birch	210.5	65.8	144.7	305.0	141.9	163.1
All types	6,578.6	3,139.9	3,438.7	13,065.6	7,625.0	5,440.6

[a] International ¼-inch rule.

Table 17.—Net volume of growing stock on commercial forest land, by species and diameter classes, New Hampshire, 1973

[In millions of cubic feet]

Species	All classes	Diameter class (inches at breast height)									
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
White and red pine[a]	1,456.3	220.3	187.6	206.6	194.5	179.4	152.7	102.3	67.0	116.2	29.7
Balsam fir	541.3	161.2	153.0	126.5	58.7	25.1	10.1	5.4	—	1.3	—
Spruce	547.6	161.8	146.3	101.9	52.6	36.6	26.1	11.4	7.1	2.5	1.3
Hemlock	563.9	88.6	92.5	107.9	95.1	76.8	46.2	23.1	16.4	14.2	3.1
Other softwoods	30.8	2.1	5.2	5.8	8.6	7.2	1.2	—	—	.7	—
Total softwoods	3,139.9	634.0	584.6	548.7	409.5	325.1	236.3	142.2	90.5	134.9	34.1
Sugar maple	450.5	77.2	73.5	82.8	63.5	44.3	29.0	22.1	20.9	33.4	3.8
Red maple	854.8	213.8	216.4	177.0	111.7	65.7	36.2	12.5	8.3	12.8	4.
Yellow birch	416.5	57.2	62.3	79.5	65.2	49.9	34.9	24.6	17.7	22.7	2.5
Paper birch	399.9	115.3	110.6	89.4	45.7	23.8	8.3	3.6	1.3	1.9	—
Beech	271.1	46.2	41.6	58.6	36.1	35.6	28.3	9.3	7.7	6.7	1.0
Ash	132.2	29.3	30.3	24.3	19.0	11.4	7.1	4.8	2.0	2.6	1.4
White oak	53.1	17.4	10.4	11.3	4.5	3.9	2.7	1.1	1.1	—	.7
Northern red oak[b]	570.1	65.9	89.2	110.5	104.0	75.2	50.9	42.6	14.8	16.4	.6
Black cherry	37.0	14.8	11.0	6.3	3.4	.5	1.0	—	—	—	—
Aspen	153.2	41.8	40.3	39.6	18.0	10.0	3.5	—	—	—	—
Other hardwoods	100.3	31.5	27.5	16.9	8.6	6.9	2.9	2.3	2.2	.8	.7
Total hardwoods	3,438.7	710.4	713.1	696.2	479.7	327.2	204.8	122.9	76.0	97.3	11.1
All species	6,578.6	1,344.4	1,297.7	1,244.9	889.2	652.3	441.1	265.1	166.5	232.2	45.2

[a] Includes 49,100,000 cubic feet of red pine.
[b] Includes 39,900,000 cubic feet of black oak.

Table 18.—Net volume of sawtimber on commercial land, by species and diameter classes, New Hampshire, 1973

[In millions of board feet][a]

Species	All classes	Diameter class (inches at breast height)							
		9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
White and red pine[b]	4,286.6	683.9	753.8	751.5	668.1	465.5	305.3	525.1	133.4
Balsam fir	865.3	449.8	236.3	103.9	42.2	26.0	—	7.1	—
Spruce	922.0	360.8	206.6	149.4	113.0	45.3	30.8	9.4	6.7
Hemlock	1,462.1	359.5	367.3	316.2	192.3	99.0	66.5	55.5	5.8
Other softwoods	89.0	19.0	31.8	29.4	5.3	—	—	3.5	—
Total softwoods	7,625.0	1,873.0	1,595.8	1,350.4	1,020.9	635.8	402.6	600.6	145.9
Sugar maple	895.7	—	225.7	179.4	126.5	101.4	92.3	151.3	19.1
Red maple	977.7	—	406.1	264.1	153.1	55.4	38.4	58.7	1.9
Yellow birch	938.2	—	248.4	211.0	159.8	110.9	85.4	111.8	10.9
Paper birch	349.0	—	179.3	98.0	38.1	17.5	6.5	9.6	—
Beech	530.2	—	135.1	149.6	126.1	44.5	34.5	35.2	5.2
Ash	199.2	—	71.1	48.3	30.3	21.1	9.0	12.1	7.3
White oak	56.6	—	16.9	15.9	11.4	4.6	5.0	—	2.8
Northern red oak[c]	1,249.8	—	392.9	307.8	218.0	187.7	66.6	73.7	3.1
Black cherry	18.8	—	12.6	2.0	4.2	—	—	—	—
Aspen	124.0	—	67.3	41.3	15.4	—	—	—	—
Other hardwoods	101.4	—	32.7	29.2	12.1	10.0	10.2	3.8	3.4
Total hardwoods	5,440.6	—	1,788.1	1,346.6	895.0	553.1	347.9	456.2	53.7
All species	13,065.6	1,873.0	3,383.9	2,697.0	1,915.9	1,188.9	750.5	1,056.8	199.6

[a] International ¼-inch rule.
[b] Includes 90,700,000 board feet of red pine.
[c] Includes 79,500,000 board feet of black oak.

Table 19.—Net volume of sawtimber on commercial forest land, by species and quality classes, New Hampshire, 1973

[In millions of board feet][a]

Species	All classes	Standard-lumber logs			
		Grade 1	Grade 2	Grade 3	Grade 4[b]
Softwoods:					
White pine	4,195.9	49.0	419.0	2,160.5	1,567.4
Red pine	90.7	23.0	11.9	44.3	11.5
Other softwoods[c]	3,338.4	—	—	—	—
Total softwoods	7,625.0	72.0	430.9	2,204.8	1,578.9
Hardwoods:					
Sugar maple	895.7	148.1	164.1	467.4	116.1
Red maple	977.7	36.4	114.8	603.6	222.9
Yellow birch	938.2	141.0	242.4	494.5	60.3
Paper birch	349.0	27.3	71.5	199.4	50.8
Beech	530.2	19.9	56.3	337.7	116.3
Ash	199.2	26.2	50.8	79.0	43.2
White oak	56.6	1.6	13.2	28.6	13.2
Northern red oak	1,170.3	107.2	271.5	660.9	130.7
Black oak	79.5	.3	26.8	33.1	19.3
Black cherry	18.8	—	—	15.4	3.4
Aspen	124.0	1.3	10.5	72.1	40.1
Other hardwoods	101.4	9.8	9.8	65.3	16.5
Total hardwoods	5,440.6	519.1	1,031.7	3,057.0	832.8
			(In percent)		
Hardwood quality	100	10	19	56	15

[a] International ¼-inch rule.
[b] Grade 4 applies only to the pines. For hardwoods the volumes in this column are for construction logs.
[c] Species other than pine are not graded into standard-lumber grades.

Table 20.—Annual net growth, removals, and mortality of growing stock and sawtimber on commercial forest land, by species, New Hampshire, 1972

Species	Growing stock			Sawtimber		
	Annual net growth	Annual timber removals[a]	Annual mortality	Annual net growth	Annual timber removals[a]	Annual mortality
	Thousand cubic feet			*Thousand board feet*[b]		
Softwoods:						
White and red pine	70,505	18,006	2,888	217,084	69,535	8,037
Balsam fir	26,617	6,241	1,524	39,877	8,326	1,340
Spruce	7,232	3,054	1,727	24,475	5,883	1,807
Hemlock	20,835	4,780	914	50,404	20,190	968
Other softwoods	111	19	347	160	66	848
Total softwoods	125,300	32,100	7,400	332,000	104,000	13,000
Hardwoods:						
Sugar maple	13,482	3,479	360	30,396	2,889	(*)
Red maple	25,593	4,638	1,471	30,558	3,863	3,572
Yellow birch	4,872	6,277	1,272	9,781	12,142	1,826
Paper birch	16,170	4,545	1,502	15,228	3,553	1,960
Beech	7,371	1,366	828	27,680	9,324	526
Ash	3,592	624	118	8,630	2,724	605
White oak	793	196	98	1,407	8	28
Red oaks	25,876	7,355	45	65,603	23,281	(*)
Black cherry	1,699	480	(*)	977	355	(*)
Aspen	6,934	1,986	204	6,426	1,918	(*)
Other hardwoods	4,618	1,354	302	5,314	1,943	483
Total hardwoods	111,000	32,300	6,200	202,000	62,000	9,000
Total, all species	236,300	64,400	13,600	534,000	166,000	22,000

[a] Data for timber removals in this table are based on the trend from 1959 through 1972 and differ from those shown in table 27. Table 27 reports results of a canvass of timber removals for 1972.

[b] International ¼-inch rule.

(*) No mortality encountered at remeasured plot locations.

Table 21.—Annual net growth and removals of growing stock and sawtimber on commercial forest land, by ownership classes, softwoods and hardwoods, New Hampshire, 1972

Ownership	Annual net growth			Annual timber removals		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	GROWING STOCK (*thousand cubic feet*)					
National Forest	30,067	10,467	19,600	8,646	787	7,859
Other public	5,870	2,087	3,783	1,581	569	1,012
Forest industry	46,992	28,425	18,567	12,716	7,751	4,965
Farmer and other	153,371	84,321	69,050	41,457	22,993	18,464
All ownerships	236,300	125,300	111,000	64,400	32,100	32,300
	SAWTIMBER (*thousand board feet*)[a]					
National Forest	71,596	23,834	47,762	18,950	2,557	16,393
Other public	13,113	6,100	7,013	4,082	2,008	2,074
Forest industry	86,802	50,821	35,981	27,368	16,729	10,639
Farmer and other	362,489	251,245	111,244	115,600	82,706	32,894
All ownerships	534,000	332,000	202,000	166,000	104,000	62,000

[a] International ¼-inch rule.

Table 22.—Annual mortality of growing stock and sawtimber on commercial forest land, by ownership classes, causes, softwoods and hardwoods, New Hampshire, 1972

Ownership and cause	Growing stock (thousand cubic feet)			Sawtimber (thousand board feet)[a]		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
			BY OWNERSHIP CLASS			
National Forest	1,713	618	1,095	3,061	933	2,128
Other public	334	123	211	551	239	312
Forest industry	2,716	1,679	1,037	3,593	1,990	1,603
Farmer and other	8,837	4,980	3,857	14,795	9,838	4,957
All ownerships	13,600	7,400	6,200	22,000	13,000	9,000
			BY CAUSE			
Weather	2,327	1,412	915	6,540	4,656	1,884
Insects	53	53	(*)	(*)	(*)	(*)
Disease	8,758	4,857	3,901	13,051	7,579	5,472
Other	575	539	36	394	394	(*)
Unknown	1,887	539	1,348	2,015	371	1,644
All causes	13,600	7,400	6,200	22,000	13,000	9,000

[a] International ¼-inch rule.
(*) No mortality encountered at remeasured plot locations.

Table 23.—Components of annual net growth of growing stock and sawtimber on commercial forest land, softwoods and hardwoods, New Hampshire, 1972

Components	All species	Soft-woods	Hard-woods
	GROWING STOCK *Thousand cubic feet*		
Growth on initial growing-stock inventory[a]	111,581	62,946	48,635
Ingrowth—saplings that became poletimber	157,952	75,671	82,281
Gross growth	269,533	138,617	130,916
Cull increment	19,633	5,917	13,716
Annual mortality	13,600	7,400	6,200
Annual net growth	236,300	125,300	111,000
	SAWTIMBER *Thousand board feet*[b]		
Growth on initial sawtimber inventory[a]	256,317	185,335	70,982
Ingrowth—poletimber trees that became sawtimber	340,025	178,280	161,745
Gross growth	596,342	363,615	232,727
Cull increment	40,342	18,615	21,727
Annual mortality	22,000	13,000	9,000
Annual net growth	534,000	332,000	202,000

[a] Including growth on trees that were cut.
[b] International ¼-inch rule.

Table 24.—Sampling errors for major forest area and timber-volume classes in New Hampshire, 1973

Table No.	Item classification	Sampling error	
	FOREST AREA		
		Percent	
1	Forest-land area:		
	Commercial	0.8	
	Unproductive	6.9	
	Total	0.8	
2	Ownership:		
	Forest industry	2	
	Farmer owned	4	
	Misc. private	1	
	Farmer and misc. private	1	
3	Stand-size class:		
	Sawtimber stands	5	
	Poletimber stands	6	
	Sapling-seedling stands	6	
	Nonstocked areas	43	
4	Stand-volume per acre (board feet):		
	Less than 1,500	6	
	1,500 to 5,000	4	
	More than 5,000	8	
7	Area-condition class:		
	Class *50*	4	
	Class *60*	5	
	Class *70*	14	
8	Growth-per-acre class (cubic feet):		
	120 to 165	12	
	85 to 120	7	
	50 to 85	5	
	Less than 50	7	
9	Forest type:		
	White and red pine	5	
	Spruce/fir	9	
	Pitch pine	45	
	Oak/pine	31	
	Oak/hickory	14	
	Elm/ash/red maple	9	
	Maple/beech/birch	7	
	Aspen/birch	18	
	TIMBER VOLUME		
		Cubic feet	*Board feet*
		Percent	
14	Class of timber:		
	Sawtimber trees	3	—
	Poletimber trees	2	—
	All growing stock	2	—
	Rough trees	5	—
	Rotten trees	5	—
	All live trees	2	—
15	Ownership:		
	National Forest	4	7
	Other public	22	24
	Forest industry	10	12
	Farmer and other	3	3
15	Stand-size class:		
	Sawtimber stands	4	4
	Poletimber stands	7	8
	Sapling-seedling	9	12
	Nonstocked areas	*	*
16	Forest type:		
	White and red pine	6	6
	Spruce/fir	10	13
	Pitch pine	*	*
	Oak/pine	34	39
	Oak/hickory	15	18
	Elm/ash/red maple	10	12
	Maple/beech/birch	8	9
	Aspen/birch	25	32
17-18	Diameter classes (inches):		
	5.0- 6.9	3	—
	7.0- 8.9	3	—
	9.0-10.9[a]	3	5
	11.0 12.9	4	4
	13.0-14.9	4	4
	15.0-16.9	6	5
	17.0-18.9	7	6
	19.0-20.9	8	8
	21.0-28.9	9	9
	29.0 and larger	16	15
17-18	Species		
	White and red pine	6	6
	Balsam fir	9	11
	Spruce	8	9
	Hemlock	8	9
	Other softwoods	31	34
	All softwoods	3	4
	Sugar maple	8	10
	Red maple	5	9
	Yellow birch	7	9
	Paper birch	8	12
	Beech	10	13
	Ash	12	16
	White oak	20	35
	Red oaks	8	10
	Black cherry	17	35
	Aspen	13	23
	Other hardwoods	12	18
	All hardwoods	3	4
	All species	2	3
	GROWTH REMOVAL		
21	Growth by:		
	Softwoods	10	11
	Hardwoods	8	12
	All species	6	8
21	Removals by:		
	Softwoods	23	23
	Hardwoods	30	25
	All species	18	20
	MORTALITY		
22	By species group:		
	Softwoods	16	24
	Hardwoods	16	39
	All species	13	20
22	By cause:		
	Weather	32	40
	Insects	*	—
	Disease	14	24
	Other	35	*
	Unknown	26	*

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* Sampling errors of 50 to 99 percent.

[a] Board-foot sampling error for this class is for softwoods only.

Table 25.—Output of timber products, by source of material, softwoods and hardwoods, New Hampshire, 1972

Product and species group	Standard units	Total output		Output from roundwood		Output from plant byproducts	
		Number of units	Thousand cubic feet	Number of units	Thousand cubic feet	Number of units	Thousand cubic feet
Sawlogs:							
Softwood	M bd. ft.[a]	133,463	22,649	133,463	22,649	—	—
Hardwood	M bd. ft.[a]	48,519	7,817	48,519	7,817	—	—
Total	M bd. ft.[a]	181,982	30,466	181,982	30,466	—	—
Veneer logs and bolts:							
Softwood	M bd. ft.[a]	—	—	—	—	—	—
Hardwood	M bd. ft.[a]	2,067	333	2,067	333	—	—
Total	M bd. ft.[a]	2,067	333	2,067	333	—	—
Pulpwood:							
Softwood	Std. cords[b]	137,973	11,718	63,873	5,429	74,100	6,289
Hardwood	Std. cords[b]	173,435	14,742	136,835	11,631	36,600	3,111
Total	Std. cords[b]	311,408	26,460	200,708	17,060	110,700	9,400
Cooperage logs and bolts:							
Softwood	M bd. ft.[a]	1,972	335	1,972	335	—	—
Hardwood	M bd. ft.[a]	—	—	—	—	—	—
Total	M bd. ft.[a]	1,972	335	1,972	335	—	—
Piling:							
Softwood	M linear ft.	6	3	6	3	—	—
Hardwood	M linear ft.	—	—	—	—	—	—
Total	M linear ft.	6	3	6	3	—	—
Posts (round and split):							
Softwood	M pieces	10	9	10	9	—	—
Hardwood	M pieces	10	8	10	8	—	—
Total	M pieces	20	17	20	17	—	—
Other:[c]							
Softwood	M cu. ft.	188	188	86	86	102	102
Hardwood	M cu. ft.	1,911	1,911	1,905	1,905	6	6
Total	M cu. ft.	2,099	2,099	1,991	1,991	108	108
Total industrial products:							
Softwood	M cu. ft.	—	34,902	—	28,511	—	6,391
Hardwood	M cu. ft.	—	24,811	—	21,694	—	3,117
Total	M cu. ft.	—	59,713	—	50,205	—	9,508
Fuelwood:							
Softwood	Std. cords	5,562	445	—	—	5,562	445
Hardwood	Std. cords	24,031	1,922	18,668	1,493	5,363	429
Total	Std. cords	29,593	2,367	18,668	1,493	10,925	874
All products:[d]							
Softwood	M cu. ft.	—	35,347	—	28,511	—	6,836
Hardwood	M cu. ft.	—	26,733	—	23,187	—	3,546
Total	M cu. ft.	—	62,080	—	51,698	—	10,382[e]

[a] International ¼-inch rule.

[b] Rough wood basis, includes chips converted to equivalent standard cords.

[c] Includes dimension, excelsior, and turnery bolts.

[d] Does not include 3,212,000 cubic feet of softwood and 990,000 cubic feet of hardwood residues used for agricultural bedding.

[e] Pulpwood from plant residues does not agree with table 6 in Resource Bulletin NE-35, *Primary Wood-Products Industries of New Hampshire and Vermont, 1972,* because of different data sources.

Table 26.—Output of roundwood products, by source, softwoods and hardwoods, New Hampshire, 1972

[In thousands of cubic feet]

Product and species group	All sources	Growing-stock trees[a]			Rough and rotten trees[a]	Salvable dead trees[a]	Other sources[b]
		Total	Sawtimber	Poletimber			
			PRINCIPAL INDUSTRIAL PRODUCTS				
Sawlogs:							
Softwood	22,649	19,879	19,635	244	222	176	2,372
Hardwood	7,817	7,206	6,956	250	99	31	481
Total	30,466	27,085	26,591	494	321	207	2,853
Veneer logs and bolts:							
Softwood	—	—	—	—	—	—	—
Hardwood	333	312	301	11	—	—	21
Total	333	312	301	11	—	—	21
Pulpwood:							
Softwood	5,429	5,091	3,767	1,324	—	36	302
Hardwood	11,631	8,822	7,439	1,383	1,469	517	823
Total	17,060	13,913	11,206	2,707	1,469	553	1,125
			MISCELLANEOUS INDUSTRIAL PRODUCTS				
Cooperage logs and bolts:							
Softwood	335	299	295	4	—	—	36
Hardwood	—	—	—	—	—	—	—
Total	335	299	295	4	—	—	36
Piling:							
Softwood	3	3	3	—	—	—	—
Hardwood	—	—	—	—	—	—	—
Total	3	3	3	—	—	—	—
Posts (round and split):							
Softwood	9	8	6	2	—	—	1
Hardwood	8	6	3	3	1	—	1
Total	17	14	9	5	1	—	2
Other:							
Softwood	86	79	53	26	4	—	3
Hardwood	1,905	1,463	791	672	141	—	301
Total	1,991	1,542	844	698	145	—	304
Total industrial products:							
Softwood	28,511	25,359	23,759	1,600	226	212	2,714
Hardwood	21,694	17,809	15,490	2,319	1,710	548	1,627
Total	50,205	43,168	39,249	3,919	1,936	760	4,341
			NONINDUSTRIAL PRODUCTS				
Fuelwood:							
Softwood	—	—	—	—	—	—	—
Hardwood	1,493	961	493	468	95	94	343
Total	1,493	961	493	468	95	94	343
Total, all products:							
Softwood	28,511	25,359	23,759	1,600	226	212	2,714
Hardwood	23,187	18,770	15,983	2,787	1,805	642	1,970
Total	51,698	44,129	39,742	4,387	2,031	854	4,684

[a] On commercial forest land.

[b] Includes trees less than 5.0 inches in diameter, tree tops and limbs from commercial forest areas, or any material from noncommercial forest land or nonforest land such as fence rows and suburban areas.

Table 27.—Timber removals from growing stock and sawtimber on commercial forest land, by items, softwoods and hardwoods, New Hampshire, 1972

Item	Growing stock			Sawtimber		
	All species	Soft-woods	Hard-woods	All species	Soft-woods	Hard-woods
	Thousand cubic feet			*Thousand board feet*[a]		
Roundwood products:						
Sawlogs	27,085	19,879	7,206	131,797	95,548	36,249
Veneer logs and bolts	312	—	312	1,428	—	1,428
Pulpwood	13,913	5,091	8,822	50,329	17,262	33,067
Cooperage logs and bolts	299	299	—	1,151	1,151	—
Piling	3	3	—	15	15	—
Posts	14	8	6	38	24	14
Other	1,542	79	1,463	3,834	213	3,621
Fuelwood	961	—	961	2,256	—	2,256
All products	44,129	25,359	18,770	190,848	114,213	76,635
Logging residues	10,039	4,537	5,502	17,000	6,287	10,713
Other removals	10,780	5,262	5,518	22,260	12,773	9,487
Total removals	64,948	35,158	29,790	230,108	133,273	96,835

[a] International ¼-inch rule.

Table 28.—Volume of unused residues at primary manufacturing plants, by industry and type of residue, and softwoods and hardwoods, New Hampshire, 1972

[In thousands of cubic feet]

Species group and type of residues	All industries	Lumber	Veneer and plywood	Other
Softwoods:				
Coarse[a]	656	631	—	25
Fine[b]	602	588	—	14
Total	1,258	1,219	—	39
Hardwoods:				
Coarse[a]	74	65	—	9
Fine[b]	146	142	—	4
Total	220	207	—	13
All species:				
Coarse[a]	730	696	—	34
Fine[b]	748	730	—	18
Total	1,478	1,426	—	52

[a] Material such as slabs, edgings, and veneer cores.
[b] Material such as sawdust and shavings.

Table 29.—Projections of net annual growth, timber removals, and inventory of growing stock and sawtimber on commercial forest land in New Hampshire, 1973-2003[a]

Species group	1973 (inventory year)	1983	1993	2003
	GROWING STOCK *(thousand cubic feet)*			
Softwoods:				
Removals	32.1	37	43	52
Growth	125.3	130	126	122
Inventory	3,139.9	3,568	3,842	4,153
Hardwoods:				
Removals	32.2	37	44	53
Growth	111.0	115	112	108
Inventory	3,438.7	3,907	4,208	4,547
Total:				
Removals	64.4	74	87	105
Growth	236.3	245	238	230
Inventory	6,578.6	7,475	8,050	8,700
	SAWTIMBER *(thousand board feet)*			
Softwoods:				
Removals	104.0	119	139	168
Growth	332.0	344	344	323
Inventory	7,625.0	8,663	9,329	10,084
Hardwoods:				
Removals	62.0	71	85	83
Growth	202.0	209	204	197
Inventory	5,440.6	6,182	6,658	7,194
Total:				
Removals	166.0	190	224	251
Growth	534.0	553	538	520
Inventory	13,065.6	14,845	15,987	17,278

[a] Based upon the following assumptions: The area of commercial forest will decrease at a constant rate of 0.35 percent per year. Net annual growth as a percentage of inventory will increase and then decline as optimum stocking is reached and then exceeded. Timber removals will reflect expected timber-product demands and land-use changes.

Table 30.—Projections of net annual growth, timber removals, and inventory of growing stock and sawtimber on commercial forest land in New Hampshire, 1973-2003[a]

Species group	1973 (inventory year)	1983	1993	2003
	GROWING STOCK *(thousand cubic feet)*			
Softwoods:				
Removals	32.1	58	90	119
Growth	125.3	137	138	120
Inventory	3,139.9	3,819	4,290	4,447
Hardwoods:				
Removals	32.2	58	90	120
Growth	111.0	121	122	119
Inventory	3,438.7	4,183	4,698	4,870
Total:				
Removals	64.4	116	180	239
Growth	236.3	258	260	239
Inventory	6,578.6	8,002	8,988	9,317
	SAWTIMBER *(thousand board feet)*			
Softwoods:				
Removals	104.0	188	292	386
Growth	332.0	363	366	318
Inventory	7,625.0	9,273	10,417	10,798
Hardwoods:				
Removals	62.0	112	173	231
Growth	202.0	220	222	217
Inventory	5,440.6	6,618	7,433	7,705
Total:				
Removals	166.0	300	465	617
Growth	534.0	583	588	535
Inventory	13,065.6	15,891	17,850	18,503

[a] Based upon the following assumptions: The area of commercial forest will decrease at a constant rate of 0.35 percent per year. Total growing stock growth and removals will be in balance at 2.6 percent of the inventory at the end of 30 years.

Table 31.—Area by land classes, geographic units, and counties, New Hampshire, 1973

Unit and county	Total land area[a]	Nonforest land use	Forest-land area: Non-commercial[b]	Forest-land area: Commercial		Forest-land area: Sampling error[c]
	Thousand acres				*Percent*	
Carroll	600.2	50.8	34.6	514.8	86	2
Coos	1,164.7	57.1	101.0	1,006.6	86	1
Grafton	1,108.3	114.9	103.0	890.4	80	2
Northern Unit	2,873.2	222.8	238.6	2,411.8	84	0.6
Belknap	256.1	50.2	2.3	203.6	80	5
Cheshire	457.8	66.9	8.0	382.9	84	3
Hillsborough	571.6	115.5	14.6	411.5	77	4
Merrimack	595.3	110.1	6.9	478.3	80	3
Rockingham	442.0	111.4	14.8	315.8	71	4
Strafford	240.3	56.1	2.7	181.5	76	5
Sullivan	344.8	63.0	5.2	276.6	80	5
Southern Unit	2,907.9	573.2	54.5	2,280.2	78	1.4
Total	5,781.1	796.0	293.1	4,692.0	81	0.8

[a] Source: Areas of New Hampshire: 1960 (December 1966), Bureau of the Census.

[b] Includes nonproductive and productive-reserved forest land.

[c] In percent for commercial forest land, at the 68-percent probability level.

Table 32.—Area of commercial forest land, by ownership classes, geographic units, and counties, New Hampshire, 1973

[In thousands of acres]

Unit and county	Public-owned[a]: National Forest[b]	Public-owned[a]: State	Public-owned[a]: County and municipal	Private-owned: Farmer-owned	Private-owned: Other private	Total
Carroll	124.4	8.8	3.1	12.1	366.4	514.8
Coos	127.9	10.0	1.9	40.1	826.7	1,006.6
Grafton	236.9	13.3	3.3	61.1	575.8	890.4
Northern Unit	489.2	32.1	8.3	113.3	1,768.9	2,411.8
Belknap	.9	2.3	2.1	9.4	188.9	203.6
Cheshire	1.2	13.0	2.2	12.1	354.4	382.9
Hillsborough	1.9	4.4	5.2	18.7	411.3	441.5
Merrimack	8.6	14.9	4.6	21.5	428.7	478.3
Rockingham	—	6.3	2.2	14.4	292.9	315.8
Strafford	—	1.4	1.1	11.6	167.4	181.5
Sullivan	—	4.8	3.2	14.4	254.2	276.6
Southern Unit	12.6	47.1	20.6	102.1	2,097.8	2,280.2
Total	501.8	79.2	28.9	215.4	3,866.7	4,692.0

[a] From ownership records.

[b] Includes 12,600 acres of other federal in the Southern unit.

Table 33.—Area of commercial forest land, by stand-size classes, geographic units, and counties, New Hampshire, 1973

[In thousands of acres]

Unit and county	Sawtimber stands	Poletimber stands	Sapling-seedling stands	Nonstocked areas	Total
Carroll	192.7	183.9	133.0	5.2	514.8
Coos	409.9	351.5	237.6	7.6	1,006.6
Grafton	342.9	336.4	202.6	8.5	890.4
Northern Unit	945.5	871.8	573.2	21.3	2,411.8
Belknap	90.4	62.1	50.0	1.1	203.6
Cheshire	167.8	122.7	91.1	1.3	382.9
Hillsborough	200.5	131.4	106.5	3.1	441.5
Merrimack	194.0	149.0	132.6	2.7	478.3
Rockingham	149.9	86.3	77.5	2.1	315.8
Strafford	81.2	49.0	50.0	1.3	181.5
Sullivan	116.9	83.3	74.1	2.3	276.6
Southern Unit	1,000.7	683.8	581.8	13.9	2,280.2
Total	1,946.2	1,555.6	1,155.0	35.2	4,692.0

Table 34.—Area of commercial forest land, by stand-volume classes and geographic units, New Hampshire, 1973

Stand-volume per acre (board feet)[a]	Northern unit		Southern unit		State total	
	Thousand acres	Percent	Thousand acres	Percent	Thousand acres	Percent
Less than 1,500	783.4	32	639.1	28	1,422.5	30
1,500 to 5,000	1,177.8	49	1,180.9	52	2,358.7	50
More than 5,000	450.6	19	460.2	20	910.8	20
All classes	2,411.8	100	2,280.2	100	4,692.0	100

[a] International ¼-inch rule.

Table 35.—Area of commercial forest land, by potential site productivity and geographic units, New Hampshire, 1973

[In thousands of acres]

Growth-per-acre class (cubic feet)	Northern unit	Southern unit	Total
120 to 165	305.9	144.6	450.5
85 to 120	668.1	507.8	1,175.9
50 to 85	794.3	948.2	1,742.5
Less than 50	643.5	679.6	1,323.1
All classes	2,411.8	2,280.2	4,692.0

Table 36.—Area of commercial forest land, by forest types, geographic units, and counties, New Hampshire, 1973

[In thousands of acres]

Unit and county	Forest type								Total
	White and red pine	Spruce/fir	Pitch pine	Oak/pine	Oak/hickory	Elm/ash/red maple	Maple/beech/birch	Aspen/birch	
Carroll	82.0	122.8	2.0	5.7	18.2	46.7	207.1	30.3	514.8
Coos	163.9	279.2	3.1	13.6	36.0	85.5	370.9	54.4	1,006.6
Grafton	124.6	197.1	2.0	9.4	31.3	80.1	390.2	55.7	890.4
Northern Unit	370.5	599.1	7.1	28.7	85.5	212.3	968.2	140.4	2,411.8
Belknap	90.8	3.7	2.6	3.1	20.7	44.7	30.1	7.9	203.6
Cheshire	156.6	5.7	4.1	5.9	44.4	90.2	61.8	14.2	382.9
Hillsborough	185.8	7.0	5.2	9.8	47.5	99.2	69.2	17.8	441.5
Merrimack	193.5	6.9	5.9	11.2	49.5	118.8	71.3	21.2	478.3
Rockingham	147.1	5.7	4.0	5.3	29.6	67.7	43.0	13.4	315.8
Strafford	79.3	3.1	2.2	3.4	18.5	41.2	25.3	8.5	181.5
Sullivan	121.0	4.7	4.7	5.3	27.2	63.5	39.4	10.8	276.6
Southern Unit	974.1	36.8	28.7	44.0	237.4	525.3	340.1	93.8	2,280.2
Total	1,344.6	635.9	35.8	72.7	322.9	737.6	1,308.3	234.2	4,692.0

Table 37.—Net volume of timber on commercial forest land, by class of timber and geographic units, New Hampshire, 1973

[In millions of cubic feet]

Class of timber	Northern unit	Southern unit	Total
Sawtimber trees:			
Sawlog portion	1,379.0	1,366.3	2,745.3
Upper-stem portion	265.0	230.0	495.0
All sawtimber trees	1,644.0	1,596.3	3,240.3
Poletimber trees	1,787.0	1,551.3	3,338.3
All growing-stock trees	3,431.0	3,147.6	6,578.6
Rough trees	232.2	304.8	537.0
Rotten trees	214.3	112.5	326.8
Total, all timber	3,877.5	3,564.9	7,442.4

Table 38.—Net volume of growing stock on commercial forest land, by tree classes, geographic units, and counties, New Hampshire, 1973

[In millions of cubic feet]

Unit and county	Sawtimber trees	Pole-timber trees	Total growing stock
Carroll	344.7	369.3	714.0
Coos	687.1	766.6	1,453.7
Grafton	612.2	651.1	1,263.3
Northern Unit	1,644.0	1,787.0	3,431.0
Belknap	146.2	140.3	286.5
Cheshire	265.3	268.0	533.3
Hillsborough	315.2	305.1	620.3
Merrimack	316.4	318.9	635.3
Rockingham	237.8	216.8	454.6
Strafford	128.2	119.8	248.0
Sullivan	187.2	182.4	369.6
Southern Unit	1,596.3	1,551.3	3,147.6
Total	3,240.3	3,338.3	6,578.6

Table 39.—Net volume of growing stock and sawtimber on commercial forest land, by ownership classes, softwoods and hardwoods, and geographic units, New Hampshire, 1973

Ownership class	Growing stock (million cubic feet)			Sawtimber (million board feet)[a]		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
NORTHERN UNIT						
National Forest	869.5	262.3	607.2	1,833.8	547.4	1,286.4
Other public	62.6	21.4	41.2	134.7	60.3	74.4
Forest industry	1,199.5	684.3	515.2	2,021.8	1,098.7	923.1
Farmer and other	1,299.4	604.3	695.1	2,624.2	1,535.7	1,088.5
All ownerships	3,431.0	1,572.3	1,858.7	6,614.5	3,242.1	3,372.4
SOUTHERN UNIT						
National Forest	—	—	—	—	—	—
Other public	106.9	30.9	76.0	194.3	79.8	114.5
Forest industry	88.0	28.0	60.0	114.5	68.5	46.0
Farmer and other	2,952.7	1,508.7	1,444.0	6,142.3	4,234.6	1,907.7
All ownerships	3,147.6	1,567.6	1,580.0	6,451.1	4,382.9	2,068.2

[a] International ¼-inch rule.

Table 40.—Net volume of growing stock and sawtimber on commercial forest land, by stand-size classes, softwoods and hardwoods, and geographic units, New Hampshire, 1973

Stand-size class	Growing stock (million cubic feet)			Sawtimber (million board feet)[a]		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
NORTHERN UNIT						
Sawtimber stands	1,739.9	821.3	918.6	4,536.7	2,148.1	2,388.6
Poletimber stands	1,365.7	565.1	800.6	1,663.8	825.3	838.5
Other stands	325.4	185.9	139.5	414.0	268.7	145.3
All stands	3,431.0	1,572.3	1,858.7	6,614.5	3,242.1	3,372.4
SOUTHERN UNIT						
Sawtimber stands	1,813.8	1,107.9	705.9	4,693.3	3,439.1	1,254.2
Poletimber stands	958.0	289.8	668.2	1,168.9	547.7	621.2
Other stands	375.8	169.9	205.9	588.9	396.1	192.8
All stands	3,147.6	1,567.6	1,580.0	6,451.1	4,382.9	2,068.2

[a] International ¼-inch rule.

Table 41.—Net volume of growing stock on commerccial forest land, by stand-size classes, geographic units, and counties, New Hampshire, 1973

Unit and county	Sawtimber stands	Poletimber stands	Other stands	Total	Sampling error of total
		Million cubic feet			*Percent*
Carroll	355.9	284.5	73.6	714.0	7
Coos	752.2	559.8	141.7	1,453.7	4
Grafton	631.8	521.4	110.1	1,263.3	5
Northern Unit	1,739.9	1,365.7	325.4	3,431.0	2.2
Belknap	165.5	87.5	33.5	286.5	8
Cheshire	298.9	172.9	61.5	533.3	7
Hillsborough	367.2	185.2	67.9	620.3	6
Merrimack	343.4	205.9	86.0	635.3	6
Rockingham	284.1	121.2	49.3	454.6	8
Strafford	149.6	69.1	29.3	248.0	10
Sullivan	205.1	116.2	48.3	369.6	8
Southern Unit	1,813.8	958.0	375.8	3,147.6	2.5
Total	3,553.7	2,323.7	701.2	6,578.6	1.7

Table 42.—Net volume of sawtimber on commercial forest land, by stand-size classes, geographic units, and counties, New Hampshire, 1973

Unit and county	Sawtimber stands	Poletimber stands	Other stands	Total	Sampling error of total
		Million board feet[a]			*Percent*
Carroll	940.4	353.4	93.5	1,387.3	11
Coos	1,916.1	661.9	180.6	2,758.6	7
Grafton	1,680.2	648.5	139.9	2,468.6	8
Northern Unit	4,536.7	1,663.8	414.0	6,614.5	3.7
Belknap	431.6	107.2	52.6	591.4	13
Cheshire	764.0	210.5	97.6	1,072.1	10
Hillsborough	943.8	224.3	104.6	1,272.7	9
Merrimack	891.9	252.7	134.5	1,279.1	9
Rockingham	737.7	148.0	75.6	961.3	11
Strafford	388.1	83.5	46.1	517.7	14
Sullivan	536.2	142.7	77.9	756.8	12
Southern Unit	4,693.3	1,168.9	588.9	6,451.1	3.7
Total	9,230.0	2,832.7	1,002.9	13,065.6	2.6

[a] International ¼-inch rule.

Table 43.—Net volume of growing stock on commercial forest land, by forest types, geographic units, and counties, New Hampshire, 1973

[In millions of cubic feet]

Unit and county	Forest type								Total
	White and red pine	Spruce/ fir	Pitch pine	Oak/ pine	Oak/ hickory	Elm/ ash/red maple	Maple/ beech/ birch	Aspen/ birch	
Carroll	120.5	172.3	—	9.4	30.2	46.1	307.1	28.4	714.0
Coos	254.0	431.5	—	26.1	59.3	90.1	527.8	64.9	1,453.7
Grafton	181.7	290.7	—	17.0	50.3	80.7	587.3	55.6	1,263.3
Northern Unit	556.2	894.5	—	52.5	139.8	216.9	1,422.2	148.9	3,431.0
Belknap	150.1	6.5	2.6	3.6	29.3	50.3	38.5	5.6	286.5
Cheshire	254.7	9.5	4.1	6.8	63.6	105.5	79.3	9.8	533.3
Hillsborough	312.1	12.6	4.7	11.0	65.7	114.2	88.4	11.6	620.3
Merrimack	304.7	11.1	5.3	11.9	69.3	128.0	91.6	13.4	635.3
Rockingham	254.8	10.3	4.3	5.8	40.3	75.1	54.8	9.2	454.6
Strafford	131.5	5.6	2.1	3.6	23.8	44.9	31.6	4.9	248.0
Sullivan	187.8	7.3	3.5	6.3	38.0	68.8	50.8	7.1	369.6
Southern Unit	1,595.7	62.9	26.6	49.0	330.0	586.8	435.0	61.6	3,147.6
Total	2,151.9	957.4	26.6	101.5	469.8	803.7	1,857.2	210.5	6,578.6

Table 44.—Net volume of sawtimber on commercial forest land, by forest types, geographic units, and counties, New Hampshire, 1973

[In millions of board feet][a]

Unit and county	Forest type								Total
	White and red pine	Spruce/ fir	Pitch pine	Oak/ pine	Oak/ hickory	Elm/ ash/red maple	Maple/ beech/ birch	Aspen/ birch	
Carroll	270.5	266.8	—	29.0	60.4	76.0	640.8	43.8	1,387.3
Coos	586.9	641.5	—	71.6	114.2	149.6	1,109.5	85.3	2,758.6
Grafton	401.8	468.3	—	50.0	98.3	132.1	1,228.9	89.2	2,468.6
Northern Unit	1,259.2	1,376.6	—	150.6	272.9	357.7	2,979.2	218.3	6,614.5
Belknap	364.7	8.4	6.5	4.9	46.8	84.5	67.4	8.2	591.4
Cheshire	606.6	12.7	10.6	9.6	100.1	179.4	139.3	13.8	1,072.1
Hillsborough	750.6	16.2	11.8	20.6	102.9	195.5	158.5	16.6	1,272.7
Merrimack	722.1	15.2	13.6	17.0	110.0	224.1	159.9	17.2	1,279.1
Rockingham	627.4	13.2	10.8	8.4	63.7	129.5	94.1	14.2	961.3
Strafford	319.7	7.1	5.4	5.8	37.5	80.5	54.6	7.1	517.7
Sullivan	444.7	9.9	8.9	10.3	61.4	121.0	91.0	9.6	756.8
Southern Unit	3,835.8	82.7	67.6	76.6	522.4	1,014.5	764.8	86.7	6,451.1
Total	5,095.0	1,459.3	67.6	227.2	795.3	1,372.2	3,744.0	305.0	13,065.6

[a] International ¼-inch rule.

Table 45.—Net volume of growing stock on commercial forest land in Northern geographic unit, by species, and counties, New Hampshire, 1973

[In millions of cubic feet]

Species	Counties			Northern unit
	Carroll	Coos	Grafton	
White and red pine	78.8	156.4	118.4	353.6
Balsam fir	100.2	262.0	170.2	532.4
Spruce	89.1	194.2	158.9	442.2
Hemlock	47.9	101.6	85.2	234.7
Other softwoods	2.1	4.3	3.0	9.4
Total softwoods	318.1	718.5	535.7	1,572.3
Sugar maple	64.4	140.7	128.5	333.6
Red maple	74.0	132.9	131.0	337.9
Yellow birch	80.7	134.6	150.4	365.7
Paper birch	58.0	99.1	102.5	259.6
Beech	44.1	68.9	82.0	195.0
Ash	12.6	27.0	24.8	64.4
White oak	.5	1.2	1.1	2.8
Northern red oak	34.2	71.6	60.7	166.5
Black cherry	3.4	7.4	6.1	16.9
Aspen	20.4	45.3	34.9	100.6
Other hardwoods	3.6	6.5	5.6	15.7
Total hardwoods	395.9	735.2	727.6	1,858.7
All species	714.0	1,453.7	1,263.3	3,431.0

Table 46.—Net volume of growing stock on commercial forest land in Southern geographic unit, by species and counties, New Hampshire, 1973

[In millions of cubic feet]

Species	Counties							Southern unit
	Belknap	Cheshire	Hillsborough	Merrimack	Rockingham	Strafford	Sullivan	
White and red pine	101.5	173.1	218.4	211.1	177.1	92.7	128.8	1,102.7
Balsam fir	.8	1.5	1.5	2.0	1.2	.7	1.2	8.9
Spruce	10.3	16.3	21.3	19.1	17.1	9.3	12.0	105.4
Hemlock	30.9	56.5	63.5	65.4	48.4	25.6	38.9	329.2
Other softwoods	2.0	3.4	3.7	4.4	3.2	1.8	2.9	21.4
Total softwoods	145.5	250.8	308.4	302.0	247.0	130.1	183.8	1,567.6
Sugar maple	10.1	20.7	24.2	24.4	14.7	8.7	14.1	116.9
Red maple	45.9	91.3	101.4	109.2	69.3	39.2	60.6	516.9
Yellow birch	4.2	9.5	10.8	10.4	6.3	3.8	5.8	50.8
Paper birch	12.9	24.4	27.1	29.6	19.4	10.6	16.3	140.3
Beech	7.2	13.6	14.8	16.0	10.1	5.5	8.9	76.1
Ash	5.7	12.3	13.6	14.4	8.6	5.3	7.9	67.8
White oak	4.1	8.9	10.3	10.8	6.6	3.9	5.7	50.3
Northern red oak	36.9	74.1	79.1	85.2	51.6	28.9	47.8	403.6
Black cherry	1.6	3.6	4.0	4.3	2.7	1.6	2.3	20.1
Aspen	4.8	8.8	10.0	11.5	7.1	4.0	6.4	52.6
Other hardwoods	7.6	15.3	16.6	17.5	11.2	6.4	10.0	84.6
Total hardwoods	141.0	282.5	311.9	333.3	207.6	117.9	185.8	1,580.0
All species	286.5	533.3	620.3	635.3	454.6	248.0	369.6	3,147.6

Table 47.—Net volume of sawtimber on commercial forest land in Northern geographic unit, by species and counties, New Hampshire, 1973

[In millions of board feet][a]

Species	Counties			Northern unit
	Carroll	Coos	Grafton	
White and red pine	224.9	457.2	339.2	1,021.3
Balsam fir	159.8	420.3	281.8	861.9
Spruce	157.4	305.3	285.9	748.6
Hemlock	118.6	261.2	209.5	589.3
Other softwoods	4.8	9.2	7.0	21.0
Total softwoods	665.5	1,453.2	1,123.4	3,242.1
Sugar maple	136.8	287.3	270.4	694.5
Red maple	103.9	184.5	185.1	473.5
Yellow birch	196.4	321.7	369.1	887.2
Paper birch	55.5	93.4	99.7	248.6
Beech	96.8	145.6	182.1	424.5
Ash	23.2	52.9	47.8	123.9
Northern red oak	82.0	166.2	142.7	390.9
Black cherry	1.5	3.0	2.5	7.0
Aspen	16.5	34.0	30.7	81.2
Other hardwoods	9.2	16.8	15.1	41.1
Total hardwoods	721.8	1,305.4	1,345.2	3,372.4
All species	1,387.3	2,758.6	2,468.6	6,614.5

[a] International ¼-inch rule.

Table 48.—Net volume of sawtimber on commercial forest land in Southern geographic unit, by species and counties, New Hampshire, 1973

[In millions of cubic feet][a]

Species	Counties							Southern unit
	Belknap	Cheshire	Hillsborough	Merrimack	Rockingham	Strafford	Sullivan	
White and red pine	304.1	511.5	642.9	623.9	529.5	274.9	378.5	3,265.3
Balsam fir	.4	.6	.6	.7	.4	.2	.5	3.4
Spruce	16.5	28.2	33.8	33.0	27.2	14.5	20.2	173.4
Hemlock	81.8	150.7	167.8	174.4	127.9	67.4	102.8	872.8
Other softwoods	6.2	10.8	12.0	13.7	10.2	5.9	9.2	68.0
Total softwoods	409.0	701.8	857.1	845.7	695.2	362.9	511.2	4,382.9
Sugar maple	16.5	34.7	44.2	40.5	25.4	15.9	24.0	201.2
Red maple	43.4	87.0	100.2	107.6	66.7	39.1	60.2	504.2
Yellow birch	3.9	8.8	11.3	10.7	5.9	4.0	6.4	51.0
Paper birch	9.2	17.7	19.6	20.9	14.0	7.5	11.5	100.4
Beech	9.9	19.2	20.5	22.8	13.5	7.4	12.4	105.7
Ash	6.0	13.4	15.7	16.0	9.3	6.0	8.9	75.3
White oak	4.8	10.4	11.1	12.6	7.1	4.2	6.4	56.6
Northern red oak	78.2	158.4	171.2	177.3	109.5	62.3	102.0	858.9
Black cherry	.9	2.2	2.5	2.3	1.5	1.2	1.2	11.8
Aspen	4.3	7.9	8.0	9.2	5.5	2.7	5.2	42.8
Other hardwoods	5.3	10.6	11.3	13.5	7.7	4.5	7.4	60.3
Total hardwoods	182.4	370.3	415.6	433.4	266.1	154.8	245.6	2,068.2
All species	591.4	1,072.1	1,272.7	1,279.1	961.3	517.7	756.8	6,451.1

[a] International 1/4-inch rule.

Table 49.—Net volume of growing stock on commercial forest land in Northern geographic unit, by species and diameter classes, New Hampshire, 1973

[In millions of cubic feet]

Species	All classes	Diameter class (inches at breast height)									
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
White and red pine[a]	353.6	61.6	43.3	44.0	40.1	33.3	32.4	22.4	22.3	39.5	14.7
Balsam fir	532.4	155.0	151.4	125.4	58.7	25.1	10.1	5.4	—	1.3	—
Spruce	442.2	133.6	114.4	82.0	41.5	30.9	18.8	11.4	7.1	2.5	—
Hemlock	234.7	36.3	36.4	42.1	34.7	30.5	20.1	10.8	9.8	10.9	3.1
Other softwoods	9.4	1.5	2.2	2.8	2.0	.4	.5	—	—	—	—
Total softwoods	1,572.3	388.0	347.7	296.3	177.0	120.2	81.9	50.0	39.2	54.2	17.8
Sugar maple	333.6	52.4	50.5	62.5	46.9	32.9	23.9	18.2	16.5	27.0	2.8
Red maple	337.9	70.7	78.5	68.3	48.8	33.6	16.7	6.2	4.9	10.2	—
Yellow birch	365.7	46.8	51.1	63.2	58.1	48.0	33.9	23.6	16.3	22.2	2.5
Paper birch	259.6	75.6	71.3	53.5	28.6	17.9	6.8	3.2	.8	1.9	—
Beech	195.0	30.1	26.0	40.3	27.2	27.6	21.6	8.8	6.6	5.8	1.0
Ash	64.4	10.0	12.9	12.0	10.1	5.7	5.2	3.3	2.0	1.8	1.4
White oak	2.8	1.3	.5	1.0	—	—	—	—	—	—	—
Northern red oak[b]	166.5	17.5	26.6	28.0	29.5	23.8	17.2	14.6	3.7	5.0	.6
Black cherry	16.9	5.5	5.1	4.4	1.4	—	.5	—	—	—	—
Aspen	100.6	24.5	26.7	28.3	14.4	5.7	1.0	—	—	—	—
Other hardwoods	15.7	2.2	3.0	1.0	1.2	4.7	.6	.7	.8	.8	.7
Total hardwoods	1,858.7	336.6	352.2	362.5	266.2	199.9	127.4	78.6	51.6	74.7	9.0
All species	3,431.0	724.6	699.9	658.8	443.2	320.1	209.3	128.6	90.8	128.9	26.8

[a] Includes 13,000,000 cubic feet of red pine.

[b] Includes 7,400,000 cubic feet of black oak.

Table 50.—Net volume of growing stock on commercial forest land in Southern geographic unit, by species and diameter classes, New Hampshire, 1973

[In millions of cubic feet]

Species	All classes	Diameter class (inches at breast height)									
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
White and red pine[a]	1,102.7	158.7	144.3	162.6	154.4	146.1	120.3	79.9	44.7	76.7	15.0
Balsam fir	8.9	6.2	1.6	1.1	—	—	—	—	—	—	—
Spruce	105.4	28.2	31.9	19.9	11.1	5.7	7.3	—	—	—	1.3
Hemlock	329.2	52.3	56.1	65.8	60.4	46.3	26.1	12.3	6.6	3.3	—
Other softwoods	21.4	.6	3.0	3.0	6.6	6.8	.7	—	—	.7	—
Total softwoods	1,567.6	246.0	236.9	252.4	232.5	204.9	154.4	92.2	51.3	80.7	16.3
Sugar maple	116.9	24.8	23.0	20.3	16.6	11.4	5.1	3.9	4.4	6.4	1.0
Red maple	516.9	143.1	137.9	108.7	62.9	32.1	19.5	6.3	3.4	2.6	.4
Yellow birch	50.8	10.4	11.2	16.3	7.1	1.9	1.0	1.0	1.4	.5	—
Paper birch	140.3	39.7	39.3	35.9	17.1	5.9	1.5	.4	.5	—	—
Beech	76.1	16.1	15.6	18.3	8.9	8.0	6.7	.5	1.1	.9	—
Ash	67.8	19.3	17.4	12.3	8.9	5.7	1.9	1.5	—	.8	—
White oak	50.3	16.1	9.9	10.3	4.5	3.9	2.7	1.1	1.1	—	.7
Northern red oak[b]	403.6	48.4	62.6	82.5	74.5	51.4	33.7	28.0	11.1	11.4	—
Black cherry	20.1	9.3	5.9	1.9	2.0	.5	.5	—	—	—	—
Aspen	52.6	17.3	13.6	11.3	3.6	4.3	2.5	—	—	—	—
Other hardwoods	84.6	29.3	24.5	15.9	7.4	2.2	2.3	1.6	1.4	—	—
Total hardwoods	1,580.0	373.8	360.9	333.7	213.5	127.3	77.4	44.3	24.4	22.6	2.1
All species	3,147.6	619.8	597.8	586.1	446.0	332.2	231.8	136.5	75.7	103.3	18.4

[a] Includes 36,100,000 cubic feet of red pine.
[b] Includes 32,500,000 cubic feet of black oak.

Table 51.—Net volume of sawtimber on commercial forest land in Northern geographic unit, by species and diameter classes, New Hampshire, 1973

[In millions of board feet][a]

Species	All classes	Diameter class (inches at breast height)							
		9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
White and red pine[b]	1,021.3	148.8	154.5	133.0	138.4	97.9	100.9	181.2	66.6
Balsam fir	861.9	446.4	236.3	103.9	42.2	26.0	—	7.1	—
Spruce	748.6	296.0	162.7	124.6	79.8	45.3	30.8	9.4	—
Hemlock	589.3	142.5	129.9	118.0	75.5	41.7	35.8	40.1	5.8
Other softwoods	21.0	9.4	7.5	2.0	2.1	—	—	—	—
Total softwoods	3,242.1	1,043.1	690.9	481.5	338.0	210.9	167.5	237.8	72.4
Sugar maple	694.5	—	162.3	132.7	104.9	84.1	72.4	123.1	15.0
Red maple	473.5	—	168.2	135.2	71.8	27.7	23.1	47.5	—
Yellow birch	887.2	—	221.7	203.4	155.3	106.8	79.1	110.0	10.9
Paper birch	248.6	—	113.9	73.8	31.7	15.5	4.1	9.6	—
Beech	424.5	—	100.9	117.0	97.8	42.4	30.1	31.1	5.2
Ash	123.9	—	37.1	25.0	22.2	14.8	9.0	8.5	7.3
Northern red oak[c]	390.9	—	108.7	97.0	74.7	66.8	17.0	23.6	3.1
Black cherry	7.0	—	4.9	—	2.1	—	—	—	—
Aspen	81.2	—	53.4	23.1	4.7	—	—	—	—
Other hardwoods	41.1	—	4.5	19.8	2.6	3.2	3.8	3.8	3.4
Total hardwoods	3,372.4	—	975.6	827.0	567.8	361.3	238.6	357.2	44.9
All species	6,614.5	1,043.1	1,666.5	1,308.5	905.8	572.2	406.1	595.0	117.3

[a] International ¼-inch rule.
[b] Includes 36,300,000 board feet of red pine.
[c] Includes 20,200,000 board feet of black oak.

Table 52.—Net volume of sawtimber on commercial forest land in Southern geographic unit, by species and diameter classes, New Hampshire, 1973

[In millions of board feet][a]

Species	All classes	Diameter class (inches at breast height)							
		9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
White and red pine[b]	3,265.3	535.1	599.3	618.5	529.7	367.6	204.4	343.9	66.8
Balsam fir	3.4	3.4	—	—	—	—	—	—	—
Spruce	173.4	64.8	43.9	24.8	33.2	—	—	—	6.7
Hemlock	872.8	217.0	237.4	198.2	116.8	57.3	30.7	15.4	—
Other softwoods	68.0	9.6	24.3	27.4	3.2	—	—	3.5	—
Total softwoods	4,382.9	829.9	904.9	868.9	682.9	424.9	235.1	362.8	73.5
Sugar maple	201.2	—	63.4	46.7	21.6	17.3	19.9	28.2	4.1
Red maple	504.2	—	237.9	128.9	81.3	27.7	15.3	11.2	1.9
Yellow birch	51.0	—	26.7	7.6	4.5	4.1	6.3	1.8	—
Paper birch	100.4	—	65.4	24.2	6.4	2.0	2.4	—	—
Beech	105.7	—	34.2	32.6	28.3	2.1	4.4	4.1	—
Ash	75.3	—	34.0	23.3	8.1	6.3	—	3.6	—
White oak	56.6	—	16.9	15.9	11.4	4.6	5.0	—	2.8
Northern red oak[c]	858.9	—	284.2	210.8	143.3	120.9	49.6	50.1	—
Black cherry	11.8	—	7.7	2.0	2.1	—	—	—	—
Aspen	42.8	—	13.9	18.2	10.7	—	—	—	—
Other hardwoods	60.3	—	28.2	9.4	9.5	6.8	6.4	—	—
Total hardwoods	2,068.2	—	812.5	519.6	327.2	191.8	109.3	99.0	8.8
All species	6,451.1	829.9	1,717.4	1,388.5	1,010.1	616.7	344.4	461.8	82.3

[a] International ¼-inch rule.
[b] Includes 54,400,000 board feet of red pine.
[c] Includes 59,400,000 board feet of black oak.

Table 53.—Net volume of sawtimber on commercial forest land in Northern geographic unit, by species and quality classes, New Hampshire, 1973

[In millions of board feet][b]

Species	All classes	Standard-lumber logs			
		Grade 1	Grade 2	Grade 3	Grade 4[b]
Softwoods:					
White pine	985.0	30.6	131.4	492.1	330.9
Red pine	36.3	5.4	2.6	21.8	6.5
Other softwoods[c]	2,220.8	—	—	—	—
Total softwoods	3,242.1	36.0	134.0	513.9	337.4
Hardwoods:					
Sugar maple	694.5	144.2	141.1	327.7	81.5
Red maple	473.5	31.9	81.5	246.0	114.1
Yellow birch	887.2	140.2	236.0	455.9	55.1
Paper birch	248.6	25.6	67.6	123.4	32.0
Beech	424.5	19.1	52.2	253.2	100.0
Ash	123.9	26.2	35.6	39.7	22.4
Northern red oak	370.8	65.4	86.1	182.4	36.9
Black oak	20.1	.1	5.6	8.0	6.4
Black cherry	7.0	—	—	5.7	1.3
Aspen	81.2	1.3	6.6	43.0	30.3
Other hardwoods	41.1	5.6	3.1	25.3	7.1
Total hardwoods	3,372.4	459.6	715.4	1,710.3	487.1
	(In percent)				
Hardwood quality	100	14	21	51	14

[a] International ¼-inch rule.

[b] Grade 4 applies only to the pines. For hardwoods the volumes in this column are for construction logs.

[c] Species other than pine are not graded into standard-lumber grades.

Table 54.—Net volume of sawtimber on commercial forest land in Southern geographic unit, by species and quality classes, New Hampshire, 1973

[In millions of board feet][b]

Species	All classes	Standard-lumber logs			
		Grade 1	Grade 2	Grade 3	Grade 4[b]
Softwoods:					
White pine	3,210.9	18.4	287.6	1,668.4	1,236.5
Red pine	54.4	17.6	9.3	22.5	5.0
Other softwoods[c]	1,117.6	—	—	—	—
Total softwoods	4,382.9	36.0	296.9	1,690.9	1,241.5
Hardwoods:					
Sugar maple	201.2	3.9	23.0	139.7	34.6
Red maple	504.2	4.5	33.3	357.6	108.8
Yellow birch	51.0	.8	6.4	38.6	5.2
Paper birch	100.4	1.7	3.9	76.0	18.8
Beech	105.7	.8	4.1	84.5	16.3
Ash	75.3	—	15.2	39.3	20.8
White oak	56.6	1.6	13.2	28.6	13.2
Northern red oak	799.5	41.8	185.4	478.5	93.8
Black oak	59.4	.2	21.2	25.1	12.9
Black cherry	11.8	—	—	9.7	2.1
Aspen	42.8	—	3.9	29.1	9.8
Other hardwoods	60.3	4.2	6.7	40.0	9.4
Total hardwoods	2,068.2	59.5	316.3	1,346.7	345.7
			(In percent)		
Hardwood quality	100	3	15	65	17

[a] International ¼-inch rule.

[b] Grade 4 applies only to the pines. For hardwoods the volumes in this column are for construction logs.

[c] Species other than pine are not graded into standard-lumber grades.

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- Berea, Kentucky, in cooperation with Berea College.
- Burlington, Vermont, in cooperation with the University of Vermont.
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- Durham, New Hampshire, in cooperation with the University of New Hampshire.
- Hamden, Connecticut, in cooperation with Yale University.
- Kingston, Pennsylvania.
- Morgantown, West Virginia, in cooperation with West Virginia University, Morgantown.
- Orono, Maine, in cooperation with the University of Maine, Orono.
- Parsons, West Virginia.
- Pennington, New Jersey.
- Princeton, West Virginia.
- Syracuse, New York, in cooperation with the State University of New York College of Environmental Sciences and Forestry at Syracuse University, Syracuse.
- Warren, Pennsylvania.

Kingsley, Neal P.
1976. **The forest resources of New Hampshire.** Northeast For. Exp. Stn., Upper Darby, Pa.
71 p., illus. (USDA For. Serv. Resour. Bull. NE-43)

A statistical and analytical report on the third forest survey of New Hampshire. Statistical findings are based on the remeasurement of ⅕-acre plots and new 10-point cluster plots. Trends in forest-land area, timber volume, annual growth, and timber removals are discussed; also timber-products output by forest industries, based upon a canvass of industries in 1973, and the importance of timber and forests to the State's economy and environment. The report includes a discussion of the outlook for timber supplies during the next 30 years, and forest management opportunities in the State. The report includes 54 tables of statistical data.

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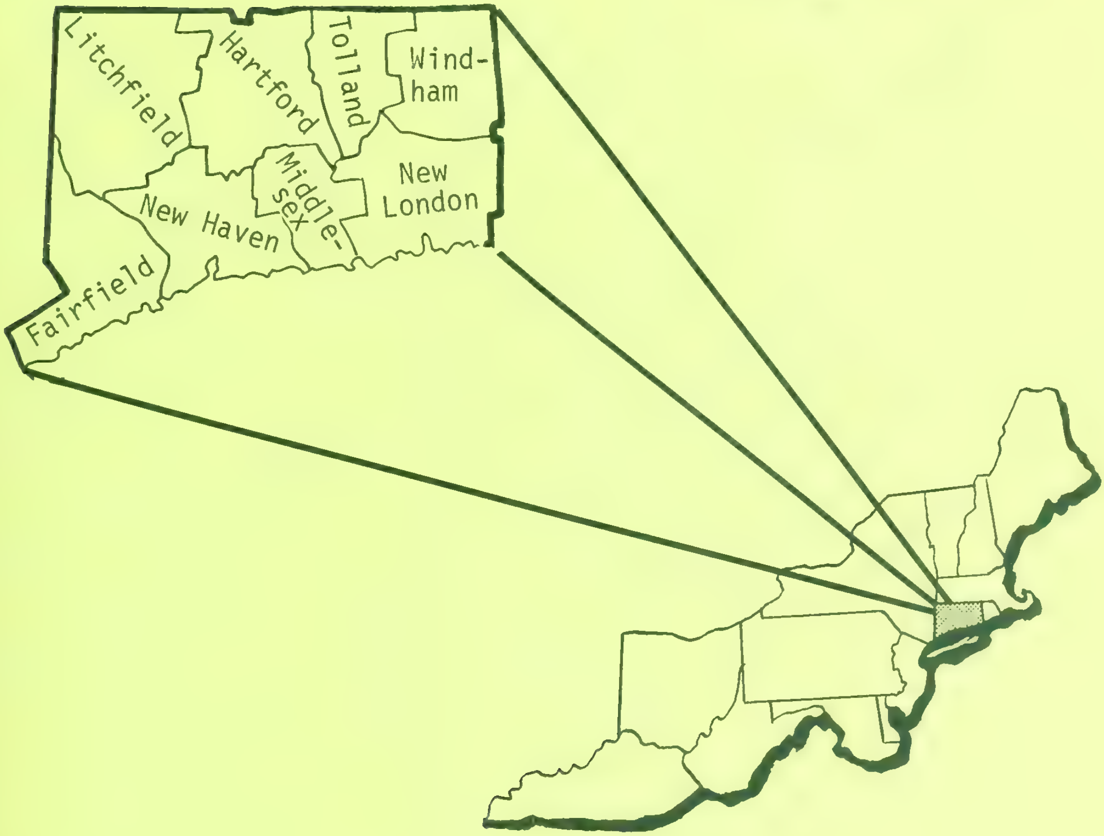

USDA FOREST SERVICE RESOURCE BULLETIN NE-44
1976

NORTHEASTERN FOREST EXPERIMENT STATION
FOREST SERVICE, U.S. DEPARTMENT OF AGRICULTURE
6816 MARKET STREET, UPPER DARBY, PA. 19082

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- Pennington, New Jersey.
- Princeton, West Virginia.
- Syracuse, New York, in cooperation with the State University of New York College of Environmental Sciences and Forestry at Syracuse University, Syracuse.
- Warren, Pennsylvania.

FOREST STATISTICS
for
CONNECTICUT

by

DAVID R. DICKSON, *Research Forester*

and

TERESA M. BOWERS, *Statistical Assistant*

Forest Survey
Northeastern Forest Experiment Station
Forest Service, U.S. Department of Agriculture
Upper Darby, Pa. 19082

THE CONNECTICUT RESURVEY

THIS REPORT contains data from the second inventory of the forest resources of Connecticut. The inventory was completed in 1971 by the Northeastern Forest Experiment Station in cooperation with the Connecticut Department of Environmental Resources. The first inventory of Connecticut was completed in 1952. Because of many differences in standards and measurement techniques, the results of the current inventory are not directly comparable to the initial inventory. The trends in the resource, after the initial data have been adjusted to the resurvey standards, are presented below:

	1953	*1972*	*Change*
COMMERCIAL FOREST LAND (thousand acres):	1,973.0	1,805.6	—167.4
GROWING STOCK VOLUME (million cubic feet):			
Softwoods	182.3	357.2	+174.9
Hardwoods	1,321.9	1,994.6	+672.7
Total	1,504.2	2,351.8	+847.6
SAWTIMBER VOLUME (million board feet):			
Softwoods	384.7	1,077.8	+693.1
Hardwoods	2,334.8	3,849.9	+1,515.1
Total	2,719.5	4,927.7	+2,208.2

The inventory statistics reported here were obtained by a sampling procedure that utilizes recent aerial photography, the partial remeasurement of ground samples from the initial inventory, and the establishment of new ground-sample locations. In Connecticut this consisted of the remeasurement of 146 plots, the interpretation of 13,000 points on aerial photographs into land-use and cubic-foot volume classes, and the location and establishment of 349 on-the-ground measurement locations as a subsample of the photo points. The data thus collected were summarized according to the Sampling with Partial Replacement (SPR) design, using the FINSYS computer system developed by the Northeastern Forest Experiment Station.

The inventory was designed to estimate resource data for the State as a whole. However, estimates for individual counties are also available, based on the photo-plot data for the particular county, expanded by the on-the-ground measurement subsample for a photo unit. Since this procedure assumes that certain attributes from the ground plots are homogeneous across county boundaries, in Connecticut every attempt has been made to develop photo units that are homogeneous for the attributes of interest. Nevertheless, the user of county data should recognize the limited and variable accuracy of the individual county estimates.

The reader may wish to consult other publications about this resurvey. THE FOREST RESOURCES OF SOUTHERN NEW ENGLAND (Resource Bulletin NE-36, 1974, by Neal P. Kingsley) provides an analysis and interpretation of the current forest resource of this region along with an evaluation of the trends since the first inventory. PRIMARY WOOD-PRODUCT INDUSTRIES OF SOUTHERN NEW ENGLAND—1971 (Resource Bulletin NE-30, by James T. Bones) reports on the complete canvass of the primary wood manufacturers and analyzes the trends in industrial wood output since 1952. THE FOREST-LAND OWNERS OF SOUTHERN NEW ENGLAND (Resource Bulletin NE-41, 1976, by Neal P. Kinsley) reports on a canvass of forest-land owners in the three southern New England states and analyzes their ownership objectives, harvesting practices, and socioeconomic characteristics.

THE FOREST RESOURCE PICTURE

Although Conneticut is located in the center of the East Coast metropolitan belt, a sizable proportion of its area is commercial forest land. When the first forest survey of the State's timber resources was completed in 1952, almost 2 million acres (63 percent) of the land area was classified as commercial forest. This was more than double the acreage of forest land that had existed 100 years earlier.[1] The upward trend has now reversed. The recently completed re-inventory of the forest resources indicates that the State's forest land decreased to 1,806 thousand acres, or 58 percent of the land area.

The distribution of acreage among the major forest types has changed between surveys. More acreage is in the softwood forest type than in 1952. In 1952 this type occupied 7 percent; in the resurvey 12 percent of the forest area was classified as softwood. The oak-hickory type is still the predominant forest type, even though the proportion decreased from 65 percent to about 40 percent of the commercial forest area.

Although the forest-land base has been reduced in the period between surveys, the volume of timber has risen substantially to an average of 1,300 cubic feet per acre. The current timber-volume data indicate that the volume of growing stock has increased to 2,352 million cubic feet, while the sawtimber volume has increased to 4,928 million board feet.

Northern red oak maintained its position as the predominant species with a net volume of 421 million cubic feet. The soft maples rank second in cubic-foot volume with 404 million, followed by the other red oaks with 272 million, and white oak with 186 million.

Softwood species currently make up 15 percent of the total net cubic-foot volume, approximately the same proportion as in 1952. Within this group, hemlock continued as the leading species with over 160 million net cubic feet. However, the growing-stock volume of red and white pines combined—173 million cubic feet—now exceeds that of hemlock. Hemlock still leads in sawtimber volume with 536 million board feet.

The results of the resurvey show that the current net growth greatly exceeds removals. The average annual net growth for the 19-year period is 61.4 million cubic feet, and the average annual removal is 16.8 million cubic feet. Softwood growing-stock removal is 18 percent of the average annual net growth for softwoods, and hardwood growing-stock removal is almost 30 percent of the average annual net growth for hardwoods. The average annual net growth of sawtimber is 162.0 million board feet, while the average annual removal is 45.8 million board feet. Removal of softwood sawtimber is slightly less than 15 percent of the average annual net growth of softwoods, and removal of hardwood sawtimber is 33 percent of the average annual net growth for hardwoods.

The soft maples ranked first in average annual net growth, with almost 12 million cubic feet. They were second in volume of average annual timber removal, a total of 2.7 million cubic feet. Northern red oak was second in average annual net growth, 11.6 million cubic feet, but first in removal with 4.0 million cubic feet.

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[1] Griswold and Ferguson. The timber resources of Connecticut. USDA For. Serv. Northeast. For. Exp. Stn. 39 p. 1957.

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DEFINITION OF TERMS

Land Area Classes

Land area.—(a) Bureau of the Census. The area of dry land and land that is temporarily or partly covered by water, such as marshes, swamps, and river flood plains; streams, sloughs, estuaries, and canals that are less than ⅛ statute mile in width; and lakes, reservoirs, and ponds that are less than 40 acres in area. (b) Forest Survey. The same as the Bureau of the Census, except that the minimum width of streams, etc. is 120 feet and the minimum size of lakes etc. is 1 acre.

Forest land.—Land that is at least 16.7 percent stocked (contains at least 7.5 square feet of basal area) by forest trees of any size, or that formerly had such tree cover and is not currently developed for nonforest use. (Forest trees are woody plants that have a well-developed stem and usually are more than 12 feet in height at maturity.) The minimum area for classification of forest land is 1 acre.

Commercial forest land.—Forest land that is producing or capable of producing crops of industrial wood (more than 20 cubic feet per acre per year) and is not withdrawn from timber utilization. (Industrial wood: all roundwood products, except fuelwood.)

Ownership Classes

Federal.—Lands (other than National Forests) that are administered by Federal agencies.

State.—Lands that are owned by the state or leased to a state for 50 years or more.

County and municipal.—Lands that are owned by counties and local public agencies or municipalities or leased to them for 50 years or more.

Forest industry.—Lands that are owned by companies or individuals operating wood-using plants.

Miscellaneous private.—Privately owned lands other than forest-industry and farmer-owned lands.

Farmer-owned.—Lands that are owned by farm operators, whether part of the farmstead or not. Excludes land leased by farm operators from non-farm owners.

Stand-Size Classes

Stand.—A growth of trees (see definitions under "Tree Classes") on a minimum of 1 acre of forest land that is at least 16.7 percent stocked by forest trees of any size.

Sawtimber stands.—Stands that are at least 16.7 percent stocked with growing-stock trees, with half or more of total stocking in sawtimber or poletimber trees, and with sawtimber stocking at least equal to poletimber stocking.

Poletimber stands.—Stands that are at least 16.7 percent stocked with growing-stock trees of which half or more of this stocking is in poletimber and/or sawtimber trees and in which poletimber stocking exceeds that of sawtimber.

Sapling-seedling stands.—Stands that are at least 16.7 percent stocked with growing-stock trees of which more than half of the stocking is sapling and/or seedlings.

Nonstocked areas.—Commercial forest land that is less than 16.7 percent stocked with growing-stock trees.

Tree Classes

Growing-stock trees.—Live trees of commercial species that are classified as sawtimber, poletimber, saplings, and seedlings; that is, all live trees of commercial species except rough and rotten trees.

Rotten trees.—Live trees of commercial species that do not contain at least one 12-foot sawlog or two nontiguous sawlogs, each 8 feet or longer, now or prospectively, and do not meet regional specifications for freedom from defect primarily because of rot; that is, when more than 50 percent of the cull volume in a tree is rotten.

Rough trees.—(a) The same as above, except that rough trees do not meet regional specifications for freedom from defect primarily because of roughness or poor form, and (b) all live trees that are of noncommercial species.

Forest Types

Forest type.—A classification of forest land based upon the species forming a plurality of basal area of live trees. The many local forest types in the Northeast were combined into the following major forest types:

White pine-red pine-hemlock.—Forests in which eastern white pine, red pine, or hemlock, singly or in combination, make up a plurality of the stocking. (Common associates include aspen, birch, and maple.)

Spruce-fir.—Forests in which spruce or true firs, singly or in combination, comprise a plurality of the stocking. (Common associates include white cedar, tamarack, maple, birch, and hemlock.)

Pitch pine-eastern redcedar.—Forests in which pitch pine or eastern redcedar, singly or in combination, make up a plurality of the stocking. (Common associates include oak and hickory.)

Oak-pine.—Forests in which oaks or hickory, singly or in combination, make up a plurality of the stocking, but in which pitch pine and/or eastern redcedar make up 25 to 50 percent of the stocking.

Oak-hickory.—Forests in which oaks or hickory, singly or in combination, make up a plurality of the stocking, except where pitch pine and/or eastern redcedar make up 25 or 50 percent, in which case the stand would be classified oak-pine. (Common associates include yellow-poplar, elm, and red maple.)

Elm-ash-red-maple.—Forests in which elm, ash, or red maple, singly or in combination, make up a plurality of the stocking. (Common associates include beech and sugar maple.)

Maple-beech-birch.—Forests in which sugar maple, beech, or yellow birch, singly or in combination, make up a plurality of the stocking. (Common associates include sweet birch, black cherry, hemlock, and white pine.)

Class of Timber

Sawtimber trees.—Live trees of commercial species, (a) that are of the following minimum diameters at breast height—softwoods 9.0 inches and hardwoods 11.0 inches, and (b) that contain at least one 12-foot or two noncontiguous 8-foot merchantable sawlogs and that meet regional specifications for freedom from defect.

Poletimber trees.—Live trees of commercial species that meet regional specifications of soundness and form, and are at least 5.0 inches dbh but are smaller than sawtimber size.

Saplings.—Live trees of commercial species tha are 1.0 to 5.0 inches dbh and of good form and vigor

Seedlings.—Live trees of commercial species tha are less than 1.0 inch dbh and are expected to survive

Timber Measurement and Volume

Growing-stock volume.—Net volume, in cubic feet, of live growing-stock trees that are 5.0 inches dbh and larger, from a 1-foot stump to a minimum 4.0-inch top diameter outside bark of the central stem, or to the point where the central stem breaks into limbs. Net volume equals gross volume less deduction for rot and/or sweep and crook.

Sawtimber volume.—Net volume in board feet, International ¼-inch rule, of merchantable sawlogs in live sawtimber trees. Net volume equals gross volume less deductions for rot, sweep, and other defects that affect use for lumber.

Annual Net Growth and Timber Removals

Average annual net growth of growing stock.—The change (resulting from natural causes) in volume of sound wood in sawtimber and poletimber trees during the period between surveys, divided by the length of the period. (Components of annual net growth of growing stock include the increment in net volume of trees present at the beginning of the period and surviving to its end, plus net volume of trees reaching poletimber size during the period, minus the net volume of trees that died during the period, minus the net volume of trees that became rough or rotten trees during the period, cull increment.)

Average annual growing-stock removals.—The net cubic-foot volume of growing-stock trees removed by harvesting or killed in logging, cultural operations such as timber-stand improvement, and land-clearing; or changes in land use during the period between surveys, converted to an annual basis.

Average annual net growth of sawtimber—The change (resulting from natural causes) in net board-foot volume of sawtimber during the period between surveys, divided by the length of the period. (Components of annual net growth of sawtimber include the increment in net volume of sawtimber trees present at the beginning of the period and surviving to its end, plus the net volume of trees reaching sawtimber size during the period, minus the net volume of sawtimber trees that died during the period, minus the net volume of sawtimber trees that became rough or rotten trees during the period between surveys, cull increment.)

Average annual sawtimber removals.—The net board-foot volume of sawtimber trees removed by harvesting or killed in logging, cultural operations such as timber-stand improvement, and land-clearing; or changes in land use during the period between surveys, converted to an annual basis.

Annual removals trend-level.—The estimated removals of growing stock or sawtimber for a specific year that are consistent with the trend of removals during the period between surveys and with the current inventory.

Logging residues.—The unused growing-stock volume of trees cut for products and the total growing-stock volume of trees destroyed in the course of logging but not removed for products.

Other removals.—The growing-stock volume of trees that were removed from the inventory and not used for products, in cultural operations (weeding, thinning, etc.), land-clearing, and reclassification of some commercial forest land as noncommercial forest land.

Plant byproducts.—Wood products such as slabs, edgings, and veneer cores that are obtained incidental to the production of timber products and are utilized in the manufacture of other timber products. (Bark is not included.)

Plant residues.—Wood material produced incidental to the production of timber products but not utilized.

Roundwood products.—Logs, bolts, or other round sections cut from growing stock or nongrowing stock for industrial or nonindustrial uses.

Timber products.—Roundwood products and plant byproducts from all sources.

Timber removals.—The growing-stock volume of trees removed from the inventory for roundwood products, plus logging residues and other removals.

Table 1.--Area by land classes, Connecticut, 1972

Land area	Area	
	Thousand acres	Percent
Forest land:		
Commercial	1,805.6	58
Productive-reserved	15.4	1
Christmas-tree plantation	15.1	(a/)
Unproductive	24.7	1
Total forest land	1,860.8	60
Nonforest:		
Cropland b/	232.4	7
Pasture b/	71.8	2
Other c/	951.8	31
Total nonforest land	1,256.0	40
Total area d/	3,116.8	100

a/ Less than 0.5 percent.

b/ Source: 1969 and 1964 Census of Agriculture. Total cropland includes cropland used for pasture. Pasture total based upon ratios developed from the 1964 census report. Data extrapolated to 1972.

c/ Includes swampland, industrial and urban areas, other nonforest land, and 24,200 acres classed as water by Forest Survey standards but defined by the Bureau of the Census as land.

d/ Source: United States Bureau of the Census, Areas of Connecticut: 1960 (May 1967).

Table 2.--Area of commercial forest land, by ownership classes, Connecticut, 1972

Ownership	Area[a/]	
	Thousand acres	Percent
Other federal	2.4	(b/)
State	119.8	7
County and municipal	24.4	1
Total public	146.6	8
Farmer owned:		
Corporate	10.4	1
Individual	117.9	6
Miscellaneous private:		
Corporate	162.3	9
Other c/	1,368.4	76
Total private	1,659.0	92
All ownerships	1,805.6	100

a/ Estimates of area in each private ownership class are based upon the forest-land ownership study.

b/ Less than 0.5 percent.

c/ Includes acreage owned by business partnerships and organizations such as churches, Boy Scouts of America, and associations.

Table 3.--Area of commercial forest land, by stand-size, stand-volume, and ownership classes, Connecticut, 1972

(In thousands of acres)

Stand-size and stand-volume class	All ownerships	Other public	Farmer and other
	BY STAND-SIZE CLASSES		
Sawtimber stands	631.0	64.8	566.2
Poletimber stands	600.1	55.4	544.7
Sapling-seedling stands	574.5	26.4	548.1
All classes[a]	1,805.6	146.6	1,659.0
	BY STAND-VOLUME PER ACRE CLASSES[b]		
Less than 1,500	564.4	40.1	524.3
1,500 to 5,000	953.3	79.9	873.4
More than 5,000	287.9	26.6	261.3
All classes	1,805.6	146.6	1,659.0

[a] No nonstocked areas in Connecticut.

[b] International 1/4-inch rule.

Table 4.--Area of commercial forest land, by stocking classes based on selected stand components, Connecticut, 1972

(In thousands of acres)

Stocking class a/ (percent)	Stocking classified in terms of--				
	All trees	Growing-stock trees			Rough and rotten trees
		Total	Desirable	Acceptable	
Overstocked:					
160	--	--	--	--	--
150 to 160	47.6	0.9	--	--	--
140 to 150	62.8	45.0	--	0.8	--
130 to 140	294.7	100.0	--	127.4	--
Total	405.1	145.9	--	128.2	--
Fully stocked:					
120 to 130	346.7	128.2	--	48.3	--
110 to 120	323.6	201.9	--	165.7	--
100 to 110	337.5	364.7	--	252.5	--
Total	1,007.8	694.8	--	466.5	--
Medium stocked:					
90 to 100	200.2	338.4	--	374.8	0.8
80 to 90	62.0	303.1	--	355.0	--
70 to 80	45.4	111.8	0.8	224.0	.8
60 to 70	27.8	64.8	--	87.3	--
Total	335.4	818.1	.8	1,041.1	1.6
Poorly stocked:					
50 to 60	29.9	31.8	16.8	37.8	--
40 to 50	14.3	28.8	2.6	45.7	93.2
30 to 40	13.1	58.0	52.0	58.1	146.6
20 to 30	--	28.2	71.2	28.2	473.7
10 to 20	--	--	320.0	--	484.2
Less than 10	--	--	1,342.2	--	606.3
Total	57.3	146.8	1,804.8	169.8	1,804.0
All classes	1,805.6	1,805.6	1,805.6	1,805.6	1,805.6

a/ Fully stocked stands are considered to be 75 to 100 square feet of basal area.

Table 5.--Area of commercial forest land, by ownership, potential site productivity, and area-condition classes, Connecticut, 1972

(In thousands of acres)

Growth-per-acre and area-condition class	All ownerships	Other public	Farmer and other
(cubic feet)	BY GROWTH-PER-ACRE CLASSES		
120 to 165	45.5	5.8	39.7
85 to 120	196.3	15.0	181.3
50 to 85	618.1	36.0	582.1
Less than 50	945.7	89.8	855.9
All classes	1,805.6	146.6	1,659.0
	BY AREA-CONDITION CLASSES[a]		
Class 10-40	0.8	0.8	--
Class 50	594.4	44.3	550.1
Class 60	1,039.5	87.5	952.0
Class 70	170.9	14.0	156.9
All classes	1,805.6	146.6	1,659.0

[a] Class 10-40.--Areas medium to fully stocked with desirable trees.

Class 50.--Areas poorly stocked with desirable trees, but fully stocked with growing-stock trees.

Class 60.--Areas poorly stocked with desirable trees, but with medium to full stocking of growing-stock trees.

Class 70.--Areas poorly stocked with desirable trees, and poorly stocked with growing-stock trees.

Table 6.--Area of commercial forest land, by forest types, ownership classes, and stand-size classes, Connecticut, 1972

(In thousands of acres)

Ownership and stand-size classes	White pine-red pine-hemlock	Spruce-fir	Pitch pine-eastern redcedar	Oak-pine	Oak-hickory	Elm-ash-red maple	Maple-beech-birch	Aspen-birch	Total
				BY OWNERSHIP CLASSES					
Other public	19.2	.9	2.0	4.6	76.0	26.2	17.4	.3	146.6
Farmer and other	161.0	15.0	27.2	98.5	654.1	389.2	287.0	27.0	1,659.0
All ownerships	180.2	15.9	29.2	103.1	730.1	415.4	304.4	27.3	1,805.6
				BY STAND-SIZE CLASSES					
Sawtimber stands	139.9	--	--	29.7	289.5	92.2	79.7	--	631.0
Poletimber stands	13.4	--	14.3	--	319.3	160.3	92.8	--	600.1
Sapling-seedling stands	26.9	15.9	14.9	73.4	121.3	162.9	131.9	27.3	574.5
All stands	180.2	15.9	29.2	103.1	730.1	415.4	304.4	27.3	1,805.6

Table 7.--Area of commercial forest land by local forest types and major forest types, Connecticut, 1972

(In thousands of acres)

Local forest type and major forest type	Acres	
	Local	Major
White pine-red pine-hemlock:		
White pine	60.1	--
Red pine	37.5	--
White pine-hemlock	26.0	--
Hemlock	56.6	--
Total	--	180.2
Spruce-fir:		
Northern white-cedar	14.9	--
Tamarack	1.0	--
Total		15.9
Pitch pine-eastern redcedar:		
Eastern redcedar	15.0	--
Pitch pine	14.2	--
Total		29.2
Oak-pine:		
White pine-red oak-white oak	72.6	--
Eastern redcedar-hardwood	13.9	--
Other oak-pine	16.6	--
Total		103.1
Oak-hickory:		
Post, black, or bear oak	113.9	--
Chestnut oak	40.6	--
White oak-red oak-hickory	150.5	--
White oak	104.8	--
Northern red oak	226.8	--
Yellow-poplar--white oak--red oak	48.4	--
Sweetgum--yellow-poplar	28.2	--
Mixed hardwoods	16.9	--
Total		730.1
Elm-ash-red maple:		
Black ash-elm-red maple	415.4	--
Total		415.4
Maple-beech-birch:		
Sugar maple-beech-yellow birch	276.2	--
Black cherry	28.2	--
Total		304.4
Aspen-birch:		
Aspen	27.3	27.3
All forest types	1,805.6	1,805.6

Table 8.--Area of noncommercial forest land, by forest types, Connecticut, 1972

(In thousands of acres)

Forest type	All areas	Productive-reserved areas	Unproductive areas
White pine-red pine-hemlock	2.0	2.0	--
Spruce-fir	17.0	15.2	1.8
Pitch pine-eastern redcedar	.2	.2	--
Oak-pine	.5	.5	--
Oak-hickory	9.8	8.0	1.8
Elm-ash-red maple	23.9	2.8	21.1
Maple-beech-birch	1.8	1.8	--
All types	55.2	30.5	24.7

Table 9.--Number of trees on commercial forest land by species groups, tree classes, and diameter classes, Connecticut, 1972

(In thousands of trees)

Dbh class (inches)	Softwoods			Hardwoods		
	Growing-stock trees	Rough and rotten trees	Total	Growing-stock trees	Rough and rotten trees	Total
Saplings:						
1.0 to 2.9	37,247	11,260	48,507	241,859	235,084	476,943
3.0 to 4.9	17,519	3,277	20,796	112,100	50,454	162,554
Total	54,766	14,537	69,303	353,959	285,538	639,497
Poletimber:						
5.0 to 6.9	12,442	1,052	13,494	87,752	12,799	100,551
7.0 to 8.9	7,674	227	7,901	59,754	2,912	62,666
9.0 to 10.9	--	--	--	37,249	2,304	39,553
Total	20,116	1,279	21,395	184,755	18,015	202,770
Small sawtimber:						
9.0 to 10.9	5,438	918	6,356	--	--	--
11.0 to 12.9	3,064	458	3,522	18,952	2,271	21,223
13.0 to 14.9	1,961	186	2,147	10,588	800	11,388
Total	10,463	1,562	12,025	29,540	3,071	32,611
Large sawtimber:						
15.0 to 16.9	1,258	45	1,303	5,512	457	5,969
17.0 to 18.9	582	34	616	2,851	280	3,131
19.0 to 20.9	323	23	346	1,383	98	1,481
21.0 to 28.9	345	47	392	1,037	220	1,257
29.0 and larger	48	7	55	77	54	131
Total	2,556	156	2,712	10,860	1,109	11,969
All classes	87,901	17,534	105,435	579,114	307,733	886,847

Table 10.--Number of growing stock trees on commercial forest land, by species and diameter classes, Connecticut, 1972

(In thousands of trees)

Species	All classes	Diameter class (inches at breast height)									
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
White pine	8,815	2,668	2,554	1,520	484	606	316	327	191	121	28
Hemlock	14,161	5,173	2,625	2,264	1,879	781	808	255	132	224	20
Other softwoods	10,159	4,601	2,495	1,654	701	574	134	--	--	--	--
All softwoods	33,135	12,442	7,674	5,438	3,064	1,961	1,258	582	323	345	48
Select white oaks	22,988	9,082	5,589	3,984	1,950	1,444	304	415	155	65	--
Select red oaks	31,876	7,112	6,830	7,441	3,993	2,721	1,883	963	533	376	24
Other white oaks	7,117	4,295	1,287	805	247	353	62	41	27	--	--
Other red oaks	20,961	4,368	4,854	4,175	3,397	2,003	1,163	600	291	110	--
Hickory	12,956	4,620	4,586	1,642	1,416	236	192	65	103	86	10
Sugar maple	9,094	2,177	3,373	1,916	750	393	227	132	24	91	11
Soft maples	62,889	33,273	16,180	8,128	2,857	1,285	755	177	105	105	24
Yellow birch	5,509	3,538	1,218	214	204	242	5	67	--	21	--
Sweet birch	21,408	9,129	6,920	3,040	1,433	484	237	62	81	22	--
Paper birch	2,689	1,338	805	353	125	59	5	4	--	--	--
Beech	4,001	1,427	1,018	831	292	291	89	35	--	18	--
White ash	11,646	3,634	3,128	2,495	1,188	670	336	105	34	56	--
Black cherry	4,175	1,347	1,287	897	441	56	82	65	--	--	--
Aspen	1,960	318	1,094	481	61	6	--	--	--	--	--
Elms	2,151	1,104	359	501	146	--	41	--	--	--	--
Other hardwoods	3,735	990	1,226	346	452	345	131	120	30	87	8
All hardwoods	225,155	87,752	59,754	37,249	18,952	10,588	5,512	2,851	1,383	1,037	77
All species	258,290	100,194	67,428	42,687	22,016	12,549	6,770	3,433	1,706	1,382	125

Table 11.--Net volume of timber on commercial forest land, by class of timber, softwoods and hardwoods, Connecticut, 1972

(In millions of cubic feet)

Class of timber	All species	Softwoods	Hardwoods
Sawtimber trees:			
Sawlog portion	1,003.0	228.0	775.0
Upper-stem portion	217.0	28.2	188.8
All sawtimber trees	1,220.0	256.2	963.8
Poletimber trees	1,131.8	101.0	1,030.8
All growing-stock trees	2,351.8	357.2	1,994.6
Rough trees	117.3	31.0	86.3
Rotten trees	47.3	2.1	45.2
Total, all timber	2,516.4	390.3	2,126.1

Table 12.--Net volume of growing stock and sawtimber on commercial forest land, by ownership classes, stand-size classes, and forest types, softwoods and hardwoods, Connecticut, 1972

Ownership, stand-size, and forest type	Growing stock (million cubic feet)			Sawtimber (million board feet)[a]		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
BY OWNERSHIP CLASSES						
Other public	211.8	42.2	169.6	414.4	112.0	302.4
Farmer and other	2,140.0	315.0	1,825.0	4,513.3	965.8	3,547.5
All ownerships	2,351.8	357.2	1,994.6	4,927.7	1,077.8	3,849.9
BY STAND-SIZE CLASSES						
Sawtimber stands	1,141.9	275.1	866.8	3,129.4	903.9	2,225.5
Poletimber stands	834.2	44.9	789.3	1,106.9	113.2	993.7
Sapling-seedling stands	375.7	37.2	338.5	691.4	60.7	630.7
All classes	2,351.8	357.2	1,994.6	4,927.7	1,077.8	3,849.9
BY FOREST TYPES						
White pine-red pine-hemlock	405.8	246.4	159.4	1,158.3	764.2	394.1
Spruce-fir	10.5	4.9	5.6	6.7	1.0	5.7
Pitch pine-eastern redcedar	16.5	11.2	5.3	30.8	21.8	9.0
Oak-pine	75.5	11.5	64.0	154.8	18.8	136.0
Oak-hickory	995.3	32.1	963.2	1,976.4	119.3	1,857.1
Elm-ash-red maple	467.0	30.9	436.1	831.3	91.0	740.3
Maple-beech-birch	374.5	20.2	354.3	751.8	61.7	690.1
Aspen-birch	6.7	--	6.7	17.6	--	17.6
All types	2,351.8	357.2	1,994.6	4,927.7	1,077.8	3,849.9

[a] International 1/4-inch rule.

Table 13.--Net volume of growing stock on commercial forest land, by species and diameter classes, Connecticut, 1972

(In millions of cubic feet)

Species	All classes	Diameter class (inches at breast height)									
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
White pine	114.6	14.1	17.5	16.8	7.8	13.9	9.4	13.1	9.8	8.4	3.8
Hemlock	162.0	20.6	16.2	22.1	26.2	16.5	23.3	10.5	7.2	16.4	3.0
Other softwoods	80.6	14.6	18.0	19.7	11.5	12.8	4.0	--	--	--	--
All softwoods	357.2	49.3	51.7	58.6	45.5	43.2	36.7	23.6	17.0	24.8	6.8
Select white oaks	185.5	24.0	28.6	36.3	27.5	30.4	9.3	16.5	8.3	4.6	--
Select red oaks	421.0	26.6	40.6	72.7	62.4	62.2	58.3	39.7	28.5	26.8	3.2
Other white oaks	47.4	13.8	7.4	8.6	4.4	8.3	1.8	1.8	1.3	--	--
Other red oaks	272.3	15.4	28.5	41.0	53.8	47.2	36.9	24.9	16.0	8.6	--
Hickory	114.6	19.8	31.5	18.4	20.2	5.1	5.5	1.4	6.2	6.5	--
Sugar maple	97.8	8.0	23.0	22.5	13.4	9.3	7.3	5.7	1.2	6.2	1.2
Soft maples	404.2	115.5	97.5	79.2	41.6	27.5	22.3	6.6	5.0	6.1	2.9
Yellow birch	32.1	12.2	6.7	2.2	3.0	4.5	.1	2.2	--	1.2	--
Sweet birch	143.9	33.4	38.8	28.8	20.4	9.4	6.4	2.1	3.4	1.2	--
Paper birch	14.9	4.5	4.1	3.4	1.7	1.0	.1	.1	--	--	--
Beech	39.1	5.4	5.9	9.7	5.3	6.8	2.8	1.7	--	1.5	--
White ash	115.6	13.1	20.9	26.4	19.5	15.7	10.2	4.0	1.7	4.1	--
Black cherry	33.1	5.0	7.7	8.5	6.4	1.1	2.2	2.2	--	--	--
Aspen	13.9	1.3	6.6	4.8	1.1	.1	--	--	--	--	--
Elms	12.1	2.8	1.7	4.5	1.9	--	1.2	--	--	--	--
Other hardwoods	47.1	3.5	6.6	3.4	7.5	7.9	4.2	5.1	1.4	6.3	1.2
All hardwoods	1,994.6	304.3	356.1	370.4	290.1	236.5	168.6	114.0	73.0	73.1	8.5
All species	2,351.8	353.6	407.8	429.0	335.6	279.7	205.3	137.6	90.0	97.9	15.3

Table 14.--Net volume of sawtimber on commercial forest land, by species and diameter classes, Connecticut, 1972

(In millions of board feet)[a]

Species	All classes	Diameter class (inches at breast height)							
		9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
White pine	357.5	54.7	31.5	61.4	43.8	60.6	46.2	40.9	18.4
Hemlock	535.8	72.8	105.0	71.3	108.7	49.5	34.3	79.5	14.7
Other softwoods	184.5	63.4	45.8	56.7	18.6	--	--	--	--
All softwoods	1,077.8	190.9	182.3	189.4	171.1	110.1	80.5	120.4	33.1
Select white oaks	381.9	--	95.9	118.9	38.0	70.5	37.4	21.2	--
Select red oaks	1,143.4	--	219.4	242.5	244.4	170.6	127.0	124.7	14.8
Other white oaks	68.0	--	15.1	32.2	7.2	7.5	6.0	--	--
Other red oaks	748.1	--	190.0	184.2	155.2	106.6	71.4	40.7	--
Hickory	177.9	--	71.3	19.9	23.3	6.1	27.6	29.7	--
Sugar maple	178.3	--	47.2	36.2	30.3	24.3	5.5	29.1	5.7
Soft maples	440.5	--	147.0	107.8	93.7	28.0	22.5	28.4	13.1
Yellow birch	44.1	--	10.7	17.9	.5	9.7	--	5.3	--
Sweet birch	166.3	--	72.9	36.9	26.9	8.7	15.3	5.6	--
Paper birch	11.0	--	5.8	4.1	.6	.5	--	--	--
Beech	72.1	--	18.8	26.8	11.8	7.4	--	7.3	--
White ash	218.6	--	69.7	61.6	43.3	17.1	7.8	19.1	--
Black cherry	45.8	--	23.0	4.2	9.1	9.5	--	--	--
Aspen	4.4	--	3.9	.5	--	--	--	--	--
Elms	11.7	--	6.7	--	5.0	--	--	--	--
Other hardwoods	137.8	--	26.9	30.6	17.4	22.3	6.2	28.7	5.7
All hardwoods	3,849.9	--	1,024.3	924.3	706.7	488.8	326.7	339.8	39.3
All species	4,927.7	190.9	1,206.6	1,113.7	877.8	598.9	407.2	460.2	72.4

Table 15.--Net volume of sawtimber on commercial forest land, by species and quality classes, Connecticut, 1972

(In millions of board feet)[a]

Species	All classes	Standard-lumber logs			
		Grade 1	Grade 2	Grade 3	Grade 4[b]
Softwoods:					
White pine	357.5	27.8	45.2	184.1	100.4
Red pine	155.7	57.9	27.4	58.9	11.5
Pitch pine	22.0	.1	7.6	14.3	--
Other softwoods[c]	542.6	--	--	--	--
Total softwoods	1,077.8	85.8	80.2	257.3	111.9
Hardwoods:					
Select white oaks	381.9	24.0	89.5	202.2	66.2
Select red oaks	1,143.4	221.5	304.9	523.0	94.0
Other white oaks	68.0	16.1	12.2	26.0	13.7
Other red oaks	748.1	92.1	162.3	406.6	87.1
Hickory	177.9	33.4	29.8	67.5	47.2
Sugar maple	178.3	15.3	39.9	87.6	35.5
Soft maple	440.5	20.6	75.1	278.1	66.7
Yellow birch	44.1	.7	5.0	31.5	6.9
Sweet birch	166.3	11.4	29.7	114.7	10.5
Paper birch	11.0	.4	1.7	8.0	.9
Beech	72.1	.6	8.3	57.1	6.1
White ash	218.6	39.2	59.3	83.7	36.4
Black cherry	45.8	--	6.8	30.5	8.5
Aspen	4.4	--	.4	3.2	.8
Elms	11.7	--	--	10.6	1.1
Other hardwoods	137.8	27.4	51.0	36.5	22.9
Total hardwoods	3,849.9	502.7	875.9	1,966.8	504.5
			(In percent)		
Hardwood quality	100	13	23	51	13

[a] International 1/4-inch rule.

[b] Grade 4 applies only to the pines. For hardwoods the volumes in this column are for construction logs.

[c] Species other than pine are not graded into standard-lumber grades.

Table 16.--Annual net growth, removals,[a/] and mortality of growing stock and sawtimber on commercial forest land, by species, Connecticut, 1972

Species	Growing stock			Sawtimber		
	Annual net growth	Annual timber removals	Annual mortality	Annual net growth	Annual timber removals	Annual mortality
	------- Thousand cubic feet --------			-------Thousand board feet[b/]--------		
Softwoods:						
White pine	4,195	214	128	14,633	992	414
Red pine	3,421	921	231	7,358	1,177	314
Hemlock	5,997	388	658	22,158	1,949	2,601
Other softwoods	787	77	350	1,451	382	66
Total softwoods	14,400	1,600	1,367	45,600	4,500	3,395
Hardwoods:						
Select white oaks	5,563	1,010	1,824	17,383	3,490	1,947
Select red oaks	13,729	3,371	2,000	45,033	5,596	776
Other red oaks	9,173	1,825	1,175	30,294	6,862	2,196
Other white oaks	1,583	155	1,675	4,216	1,589	687
Hickory	3,732	768	591	5,448	1,251	479
Sugar maple	3,358	786	74	9,273	2,389	815
Soft maples	14,018	2,235	2,004	25,640	7,695	508
Yellow birch	689	404	352	1,485	725	223
Sweet birch	2,964	445	350	3,242	501	229
Beech	1,659	473	304	4,443	1,634	995
White ash	2,243	359	561	6,750	1,678	593
Elm	-1,600	85	1,919	-2,082	3	1,801
Yellow-poplar	915	172	391	2,910	699	140
Other hardwoods	1,374	312	613	4,365	1,088	216
Total hardwoods	59,400	12,400	13,833	158,400	35,200	11,605
Total, all species	73,800	14,000	15,200	204,000	39,700	15,000

[a/] Data for timber removals in this table are based on the trend from 1952 through 1971.

[b/] International 1/4-inch rule.

Table 17.--Annual net growth and removals of growing stock and sawtimber on commercial forest land, by ownership classes, softwoods and hardwoods, Connecticut, 1971

	Annual net growth			Annual timber removals		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
			GROWING STOCK (thousand cubic feet)			
Public	7,561	1,644	5,917	775	--	775
Farmer and other	66,239	12,756	53,483	13,225	1,600	11,625
All ownerships	73,800	14,400	59,400	14,000	1,600	12,400
			SAWTIMBER (thousand board feet)[a/]			
Public	19,114	5,206	13,908	1,764	--	1,764
Farmer and other	184,886	40,394	144,492	37,936	4,500	33,436
All ownerships	204,000	45,600	158,400	39,700	4,500	35,200

[a/] International 1/4-inch rule.

Table 18.--Annual mortality of growing stock and sawtimber on commercial forest land, by ownership classes, causes, softwoods and hardwoods, Connecticut, 1971

Ownership and cause	Growing stock (thousand cubic feet)			Sawtimber (thousand board feet)[a]		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
			BY OWNERSHIP CLASS			
Public	1,201	--	1,201	1,578	--	1,578
Farmer and other	13,999	1,367	12,632	13,422	3,395	10,027
All ownerships	15,200	1,367	13,833	15,000	3,395	11,605
			BY CAUSE			
Disease	12,809	1,334	11,475	13,611	3,395	10,216
Logging	309	--	309	671	--	671
Weather	258	--	258	111	--	111
Suppression	188	--	188	352	--	352
Unknown	1,636	33	1,603	255	--	255
All causes	15,200	1,367	13,833	15,000	3,395	11,605

a/ International 1/4-inch rule.

Table 19.--Components of average annual net growth of growing stock and sawtimber on commercial forest land, softwoods and hardwoods, Connecticut, 1952-71

Components	All species	Soft-woods	Hard-woods
	GROWING STOCK (thousand cubic feet)		
Growth on initial growing-stock inventory [a]	41,174	4,106	37,068
Ingrowth--saplings that became poletimber	35,845	8,598	27,247
Gross growth	77,019	12,704	64,315
Cull increment	2,719	504	2,215
Annual mortality	12,900	1,000	11,900
Average annual net growth	61,400	11,200	50,200
	SAWTIMBER (thousand board feet)[b]		
Growth on initial sawtimber inventory [a]	71,907	19,558	52,349
Ingrowth--poletimber trees that became sawtimber	104,583	28,100	76,483
Gross growth	176,490	47,658	128,832
Cull increment	3,390	2,558	832
Annual mortality	11,100	2,600	8,500
Average annual net growth	162,000	42,500	119,500

[a] Including growth on trees that were cut.

[b] International 1/4-inch rule.

Table 20.--Sampling errors for major forest area and timber-volume classes, Connecticut, 1972

Table no.	Item classification	Sampling error
	FOREST AREA	
		Percent
1	Forest-land area:	
	Commercial	2.3
	Unproductive	*
	Total	2.5
2	Ownership:	
	Forest industry	**
	Farmer owned	28
	Misc. private	6
	Farmer and misc. private	5
3	Stand-size class:	
	Sawtimber stands	11
	Poletimber stands	12
	Sapling-seedling stands	11
4	Stand-volume per acre (board feet):	
	Less than 1,500	12
	1,500 to 5,000	8
	More than 5,000	15
7	Area-condition class:	
	Class 50	
	Class 60	7
	Class 70	26
8	Growth-per-acre class (cubic feet):	
	120 to 165	*
	85 to 120	25
	50 to 85	13
	Less than 50	9

Table no.	Item classification	Sampling error	
	TIMBER VOLUME		
		Cubic feet	Board feet
		Percent	
14	Class of timber:		
	Sawtimber trees	5	--
	Poletimber trees	5	--
	All growing stock	3	--
	Rough trees	12	--
	Rotten trees	13	--
	All live trees	3	--
15	Ownership:		
	Other public	16	18
	Forest industry	*	*
	Farmer and other	6	7
15	Stand-size class:		
	Sawtimber stands	9	8
	Poletimber stands	12	16
	Sapling-seedling	16	19
16	Forest type:		
	White pine, red pine, hemlock	19	20
	Spruce-fir	*	*
	Pitch pine-eastern redcedar	*	*
	Oak-pine	46	*
	Oak-hickory	11	13
	Elm-ash-red maple	18	23
	Maple-beech-birch	23	24
	Aspen-birch	*	*

Table	Item	Cubic feet	Board feet
9	Forest type:		
	White pine, red pine, hemlock		18
	Spruce-fir		*
	Pitch pine-eastern redcedar		*
	Oak-pine		35
	Oak-hickory		10
	Elm-ash-red maple		16
	Maple-beech-birch		20
	Aspen-birch		*
		Percent	
17-18	Species:		
	White pine	29	33
	Hemlock	25	24
	Other softwoods	46	*
	All softwoods	15	16
	Select white oaks	13	14
	Select red oaks	11	12
	Other white oaks	34	43
	Other red oaks	14	16
	Hickory	21	39
	Yellow birch	27	40
	Sweet birch	18	25
	Paper birch	34	*
	Sugar maple	27	34
	Soft maples	13	20
	Beech	30	40
	White ash	21	28
	Aspen	47	*
	Black cherry	25	36
	Elm	32	*
	Other hardwoods	24	30
	All hardwoods	4	6
	All species	2.8	4.0
17-18	Diameter classes (inches):		
	5.0- 6.9	7	--
	7.0- 8.9	7	--
	9.0-10.9 a/	6	23
	11.0-12.9	6	7
	13.0-14.9	7	8
	15.0-16.9	8	7
	17.0-18.9	10	10
	19.0-20.9	14	13
	21.0-28.9	16	15
	29.0 and larger	29	29
	GROWTH-REMOVAL		
21	Growth by:		
	Softwoods	44	36
	Hardwoods	10	8
	All species	11	8
21	Removals by:		
	Softwoods	41	*
	Hardwoods	23	32
	All species	22	31
	MORTALITY		
22	By species group:		
	Softwoods	*	*
	Hardwoods	16	30
	All species	16	36
22	By cause:		
	Weather	*	**
	Logging	*	**
	Disease	18	39
	Suppression	*	**
	Unknown	*	**

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* Sampling errors of 50 to 99 percent.

** Sampling errors of 100 percent or more.

a/ Board-foot sampling error for this class is for softwoods only.

Table 21.--Output of timber products, by source of material, softwoods and hardwoods, Connecticut, 1971

Product and species group	Standard units	Total output		Output from roundwood		Output from plant byproducts	
		Number of units	Thousand cubic feet	Number of units	Thousand cubic feet	Number of units	Thousand cubic feet
Sawlogs:							
Softwood	M bd. ft.[a]	6,009	1,007	6,009	1,007	--	--
Hardwood	M bd. ft.[a]	21,649	3,632	21,649	3,632	--	--
Total	M bd. ft.[a]	27,658	4,639	27,658	4,639	--	--
Veneer logs and bolts:							
Softwood	M bd. ft.[a]	--	--	--	--	--	--
Hardwood	M bd. ft.[a]	57	14	57	14	--	--
Total	M bd. ft.[a]	57	14	57	14	--	--
Pulpwood:							
Softwood	Std. cords[b]	4,193	356	4,181	355	12	1
Hardwood	Std. cords[b]	6,668	567	6,668	567	--	--
Total	Std. cords[b]	10,861	923	10,849	922	12	1
Cooperage logs and bolts:							
Softwood	M bd. ft.[a]	--	--	--	--	--	--
Hardwood	M bd. ft.[a]	125	17	125	17	--	--
Total	M bd. ft.[a]	125	17	125	17	--	--
Piling:							
Softwood	M linear ft.	2	1	2	1	--	--
Hardwood	M linear ft.	233	85	233	85	--	--
Total	M linear ft.	235	86				

Posts (round and split):							
Softwood	M pieces	15	12	15	12	--	--
Hardwood	M pieces	--	--	--	--	--	--
Total	M pieces	15	12	15	12	--	--
Other:c/							
Softwood	M cu. ft.	167	167	5	5	162	162
Hardwood	M cu. ft.	878	878	108	108	770	770
Total	M cu. ft.	1,045	1,045	113	113	932	932
Total industrial products:							
Softwood	M cu. ft.	--	1,543	--	1,380	--	163
Hardwood	M cu. ft.	--	5,193	--	4,423	--	770
Total	M cu. ft.	--	6,736	--	5,803	--	933
Fuelwood:							
Softwood	Std. cords	712	57	101	8	612	49
Hardwood	Std. cords	11,627	930	8,327	666	3,300	264
Total	Std. cords	12,339	987	8,428	674	3,912	313
All products:d/							
Softwood	M cu. ft.	--	1,600	--	1,388	--	212
Hardwood	M cu. ft.	--	6,123	--	5,089	--	1,034
Total	M cu. ft.	--	7,723	--	6,477	--	1,246

a/ International 1/4-inch rule.

b/ Rough wood basis, includes chips converted to equivalent standard cords.

c/ Includes dimension bolts, shingle bolts, charcoal wood, horticultural mulch, and wood novelty items.

d/ Does not include 124,000 cubic feet of softwood and 419,000 cubic feet of hardwood residues used for agricultural bedding.

Table 22.--Output of roundwood products, by source, softwoods and hardwoods, Connecticut, 1971

(In thousands of cubic feet)

Product and species group	All sources	Growing-stock trees[a/]			Rough and rotten trees a/	Salvable dead trees a/	Other sources[b/]
		Total	Sawtimber	Poletimber			
PRINCIPAL INDUSTRIAL PRODUCTS							
Sawlogs:							
Softwood	1,007	873	845	28	--	7	127
Hardwood	3,632	3,487	3,319	168	16	--	129
Total	4,639	4,360	4,164	196	16	7	256
Veneer logs and bolts:							
Softwood	--	--	--	--	--	--	--
Hardwood	14	13	13	--	--	--	1
Total	14	13	13	--	--	--	1
Pulpwood:							
Softwood	355	305	127	178	1	2	47
Hardwood	567	322	--	322	--	--	245
Total	922	627	127	500	1	2	292
MISCELLANEOUS INDUSTRIAL PRODUCTS							
Cooperage logs and bolts:							
Softwood	--	--	--	--	--	--	--
Hardwood	17	16	16	--	--	--	1
Total	17	16	16	--	--	--	1

Softwood	1	1	1	--	--	--	--
Hardwood	85	82	78	4	--	--	3
Total	86	83	79	4	--	--	3
Posts (round and split):							
Softwood	12	4	--	4	--	7	1
Hardwood	--	--	--	--	--	--	--
Total	12	4	--	4	--	7	1
Other:							
Softwood	5	2	--	2	--	2	1
Hardwood	108	71	46	25	18	4	15
Total	113	73	46	27	18	6	16
TOTAL INDUSTRIAL PRODUCTS							
Softwood	1,380	1,185	973	212	1	18	176
Hardwood	4,423	3,991	3,472	519	34	4	394
Total	5,803	5,176	4,445	731	35	22	570
NONINDUSTRIAL PRODUCTS							
Fuelwood:							
Softwood	8	3	--	3	--	4	1
Hardwood	666	437	285	152	114	23	92
Total	674	440	285	155	114	27	93
ALL PRODUCTS							
Softwood	1,388	1,188	973	215	1	22	177
Hardwood	5,089	4,428	3,757	671	148	27	486
Total	6,477	5,616	4,730	886	149	49	663

a/ On commercial forest land.

b/ Includes trees less than 5.0 inches in diameter, tree tops and limbs from commercial forest areas, or any material from noncommercial forest land or nonforest land such as fence rows and suburban areas.

Table 23.--Timber removals from growing stock and sawtimber on commercial forest land, by items, softwoods and hardwoods, Connecticut, 1971

Item	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	--------Thousand cubic feet--------			-----Thousand board feet[a]---------		
Roundwood products:						
Sawlogs	4,360	873	3,487	18,806	3,838	14,968
Veneer logs and bolts	13	--	13	59	--	59
Pulpwood	627	305	322	463	463	--
Cooperage logs and bolts	16	--	16	72	--	72
Piling	83	1	82	357	5	352
Poles	--	--	--	--	--	--
Posts	4	4	--	--	--	--
Mine timbers	--	--	--	--	--	--
Other	73	2	71	207	--	207
Fuelwood	440	3	437	1,285	--	1,285
All products	5,616	1,188	4,428	21,249	4,306	16,943
Logging residues	998	99	899	569	106	463
Other removals	11,606	348	11,258	975	50	925
Total removals	18,220	1,635	16,585	22,793	4,462	18,331

a/ International 1/4-inch rule.

Table 24.--Volume of unused residues at sawmills,[a] by type of residue for softwoods and hardwoods, Connecticut, 1971

(In thousands of cubic feet)

Type of residue	Softwoods	Hardwoods	All species
Coarse[b]	89.5	181.2	270.7
Fine[c]	1.0	10.2	11.2
Total	90.5	191.4	281.9

[a] The sawmill industry was the only industry in Connecticut with unused residues.

[b] Material such as slabs and edgings.

[c] Material such as sawdust and shavings.

Table 25.--Area by land classes and counties, Connecticut, 1972

County	Total land area[a]	Nonforest land area	Forest-land area			
			Non-commercial[b]	Commercial		Sampling error [c]
	Thousand acres				Per-cent	Percent
Fairfield	400.9	214.1	3.0	183.8	46	6
Hartford	472.8	257.6	4.8	210.4	44	7
Litchfield	595.3	174.0	22.2	399.1	67	5
Middlesex	237.8	75.4	5.0	157.4	66	7
New Haven	386.8	199.7	4.4	182.7	47	7
New London	427.0	139.8	8.4	278.8	65	6
Tolland	266.1	88.5	3.2	174.4	66	7
Windham	330.1	106.9	4.2	219.0	66	6
Total	3,116.8	1,256.0	55.2	1,805.6	58	2

a/ Source: Area Measurement Report, Bureau of the Census, Areas of Connecticut: 1960.
b/ Includes nonproductive and productive-reserved forest land.
c/ In percent for commercial forest land, at the 68 percent probability level.

Table 26.--Area of commercial forest land, by ownership classes and counties, Connecticut, 1972

(In thousands of acres)

County	Public-owned			Private-owned		Total
	Other federal	State	County and municipal	Farmer-owned	Other private	
Fairfield	--	2.8	6.0	3.5	171.5	183.8
Hartford	--	1.9	5.7	15.3	187.5	210.4
Litchfield	0.7	34.5	1.8	34.9	327.2	399.1
Middlesex	.1	25.2	1.0	5.8	125.3	157.4
New Haven	--	3.7	5.6	7.8	165.6	182.7
New London	--	22.8	1.8	26.0	228.2	278.8
Tolland	1.6	15.2	1.4	13.4	142.8	174.4
Windham	--	13.7	1.1	21.6	182.6	219.0
Total	2.4	119.8	24.4	128.3	1,530.7	1,805.6

Table 27.--Area of commercial forest land, by stand-size classes and counties, Connecticut, 1972

(In thousands of acres)

County	Sawtimber stands	Poletimber stands	Sapling-seedling stands	Total
Fairfield	51.6	68.7	63.5	183.8
Hartford	68.6	68.0	73.8	210.4
Litchfield	188.0	125.3	85.8	399.1
Middlesex	50.3	59.4	47.7	157.4
New Haven	60.7	57.6	64.4	182.7
New London	84.1	89.9	104.8	278.8
Tolland	54.4	58.5	61.5	174.4
Windham	73.3	72.7	73.0	219.0
Total	631.0	600.1	574.5	1,805.6

Table 28.--Area of commercial forest land, by forest types and counties, Connecticut, 1972

(In thousands of acres)

County	White pine-red pine-hemlock	Spruce-fir	Pitch pine-eastern redcedar	Oak-pine	Oak-hickory	Elm-ash-red maple	Maple-beech-birch	Aspen-birch	Total
Fairfield	10.0	2.3	3.7	13.1	82.6	39.9	30.7	1.5	183.8
Hartford	25.6	1.8	4.5	12.1	84.1	44.6	35.2	2.5	210.4
Litchfield	65.2	--	3.8	13.0	124.4	109.7	69.9	13.1	399.1
Middlesex	10.6	1.3	2.2	8.8	73.2	34.3	25.5	1.5	157.4
New Haven	17.4	2.7	2.8	13.1	76.9	38.2	30.2	1.4	182.7
New London	14.5	3.2	5.9	18.4	121.5	64.5	47.4	3.4	278.8
Tolland	13.2	2.1	2.6	11.2	75.5	38.5	29.5	1.8	174.4
Windham	23.7	2.5	3.7	13.4	91.9	45.7	36.0	2.1	219.0
Total	180.2	15.9	29.2	103.1	730.1	415.4	304.4	27.3	1,805.6

Table 29.--Net volume of growing stock and sawtimber on commercial forest land, by stand-size classes and counties, Connecticut, 1972

County	Sawtimber stands	Poletimber stands	Seedling-sapling stands	Total	Sampling error of total
	------------	Million cubic feet	----------------		Percent
Fairfield	83.8	95.2	44.4	223.4	11
Hartford	119.7	92.9	47.8	260.4	11
Litchfield	401.1	184.4	48.5	634.0	9
Middlesex	82.7	81.4	31.8	195.9	10
New Haven	105.2	78.1	45.2	228.5	12
New London	131.6	121.7	66.7	320.0	9
Tolland	89.9	80.0	41.3	211.2	11
Windham	127.9	100.5	50.0	278.4	10
Total	1,141.9	834.2	375.7	2,351.8	3
	-----------	Million board feet[a]	----------------		Percent
Fairfield	228.4	124.7	89.1	442.2	17
Hartford	333.8	121.5	93.3	548.6	18
Litchfield	1,092.4	263.3	64.0	1,419.7	13
Middlesex	222.2	104.8	61.9	388.9	18
New Haven	292.5	101.7	85.8	480.0	19
New London	358.8	156.4	124.0	639.2	15
Tolland	246.6	103.6	78.1	428.3	18
Windham	354.7	130.9	95.2	580.8	16
Total	3,129.4	1,106.9	691.4	4,927.7	4

a/ International 1/4-inch rule.

Table 30.--Net volume of growing stock on commercial forest land, by forest types and counties, Connecticut, 1972

County	White pine-red pine hemlock	Spruce-fir	Pitch pine-eastern redcedar	Oak-pine	Oak hickory	Elm-ash-red maple	Maple-beech-birch	Aspen-birch	Total
					Million cubic feet				
Fairfield	22.4	1.6	1.9	10.9	110.1	44.3	32.0	0.2	223.4
Hartford	53.3	1.2	2.4	9.7	110.5	46.0	37.0	.3	260.4
Litchfield	151.0	--	--	4.8	198.4	143.0	132.3	4.5	634.0
Middlesex	25.1	.8	1.6	7.5	97.1	37.5	26.0	.3	195.9
New Haven	42.8	1.8	2.4	10.0	100.2	40.1	31.0	.2	228.5
New London	30.5	2.1	3.8	13.3	158.0	65.3	46.5	.5	320.0
Tolland	27.9	1.4	2.0	8.6	99.3	40.9	30.8	.3	211.2
Windham	52.8	1.6	2.4	10.7	121.7	49.9	38.9	.4	278.4
Total	405.8	10.5	16.5	75.5	995.3	467.0	374.5	6.7	2,351.8
					Million board feet[a]				
Fairfield	68.7	0.9	3.6	22.5	205.2	74.8	66.0	0.5	442.2
Hartford	155.6	.7	4.5	20.2	210.8	75.9	80.1	.8	548.6
Litchfield	401.4	--	--	10.8	459.4	287.4	247.8	12.9	1,419.7
Middlesex	73.4	.5	2.9	16.2	181.2	61.7	52.5	.5	388.9
New Haven	129.7	1.1	4.5	19.3	191.4	70.1	63.4	.5	480.0
New London	93.7	1.4	7.1	26.5	305.2	109.5	94.7	1.1	639.2
Tolland	82.3	1.0	3.7	17.5	190.0	68.2	65.0	.6	428.3
Windham	153.5	1.1	4.5	21.8	233.2	83.7	82.3	.7	580.8
Total	1,158.3	6.7	30.8	154.8	1,976.4	831.3	751.8	17.6	4,927.7

[a] International 1/4-inch rule.

Table 31.--Net volume of growing stock on commercial forest land, by species, tree classes, and counties, Connecticut, 1972

(In millions of cubic feet)

Species	Fairfield	Hartford	Litchfield	Middlesex	New Haven	New London	Tolland	Windham	Total
BY SPECIES									
White pine	6.1	17.8	42.6	6.1	8.5	8.0	8.8	16.7	114.6
Hemlock	11.8	19.2	48.7	11.8	19.1	17.7	13.8	19.9	162.0
Other softwoods	3.6	5.8	43.3	4.0	5.2	7.8	4.0	6.9	80.6
All softwoods	21.5	42.8	134.6	21.9	32.8	33.5	26.6	43.5	357.2
Select white oaks	21.0	22.9	21.1	18.3	22.0	34.1	20.6	25.5	185.5
Select red oaks	46.7	45.1	104.1	39.6	40.0	57.5	38.9	49.1	421.0
Other white oaks	2.4	2.6	23.0	3.7	2.9	5.8	3.3	3.7	47.4
Other red oaks	29.5	36.3	32.0	27.2	32.1	46.5	29.7	39.0	272.3
Hickory	12.6	13.5	19.5	10.9	12.5	19.4	11.7	14.5	114.6
Yellow birch	3.4	3.7	7.3	3.0	3.5	4.3	2.9	4.0	32.1
Sweet birch	14.6	16.3	35.0	12.2	15.8	19.3	13.4	17.3	143.9
Paper birch	1.0	1.5	4.7	1.3	1.4	2.1	1.2	1.7	14.9
Sugar maple	7.1	7.0	48.3	5.5	6.9	9.2	6.0	7.8	97.8
Soft maples	40.5	42.8	113.3	32.8	36.8	55.8	36.4	45.8	404.2
Beech	3.3	3.4	15.6	3.0	2.9	4.4	2.9	3.6	39.1
White ash	9.8	11.2	47.5	7.9	8.5	11.3	8.1	11.3	115.6
Black cherry	2.9	3.4	10.0	2.2	3.4	5.0	2.8	3.4	33.1
Elm	1.4	1.4	2.9	1.1	1.1	1.8	1.0	1.4	12.1
Other hardwoods	5.7	6.5	15.1	5.3	5.9	10.0	5.7	6.8	61.0
All hardwoods	201.9	217.6	499.4	174.0	195.7	286.5	184.6	234.9	1,994.6
All species	223.4	260.4	634.0	195.9	228.5	320.0	211.2	278.4	2,351.8
BY TREE CLASSES									
Sawtimber	109.7	134.9	348.4	98.2	118.7	159.6	106.7	143.8	1,220.0
Poletimber	113.7	125.5	285.6	97.7	109.8	160.4	104.5	134.6	1,131.8
All classes	223.4	260.4	634.0	195.9	228.5	320.0	211.2	278.4	2,351.8

Table 32.--Net volume of sawtimber on commercial forest land, by species and counties, Connecticut, 1972

(In millions of board feet)[a]

Species	Fairfield	Hartford	Litchfield	Middlesex	New Haven	New London	Tolland	Windham	Total
White pine	17.9	53.7	145.3	17.8	26.3	22.3	24.6	49.6	357.5
Hemlock	39.2	62.3	167.5	37.7	61.7	57.8	45.2	64.4	535.8
Other softwoods	4.9	10.7	123.0	6.9	8.6	11.5	6.2	12.7	184.5
All softwoods	62.0	126.7	435.8	62.4	96.6	91.6	76.0	126.7	1,077.8
Select white oaks	43.4	46.9	41.2	38.9	45.3	70.4	42.5	53.3	381.9
Select red oaks	113.6	116.2	331.4	96.4	107.0	153.9	99.4	125.5	1,143.4
Other white oaks	4.2	4.7	26.7	6.4	5.1	9.4	5.4	6.1	68.0
Other red oaks	78.5	101.0	107.6	69.2	87.0	119.3	78.7	106.8	748.1
Hickory	14.2	15.8	67.7	11.7	14.9	23.2	13.7	16.7	177.9
Yellow birch	4.1	4.7	10.3	3.9	4.9	7.0	4.2	5.0	44.1
Sweet birch	17.8	20.1	33.8	14.7	20.8	21.5	16.1	21.5	166.3
Paper birch	.1	.1	8.7	.8	.1	.5	.4	.3	11.0
Sugar maple	11.5	12.1	93.5	8.9	12.3	16.6	10.1	13.3	178.3
Soft maples	43.5	47.3	126.7	35.4	40.4	58.4	38.5	50.3	440.5
Beech	7.7	7.6	18.1	6.7	6.7	10.5	6.8	8.0	72.1
White ash	22.3	23.6	71.8	16.6	18.3	23.7	17.7	24.6	218.6
Black cherry	3.6	4.2	16.2	2.9	4.3	6.6	3.6	4.4	45.8
Elm	1.4	1.3	3.1	1.1	1.0	1.5	1.0	1.3	11.7
Other hardwoods	14.3	16.3	27.1	12.9	15.3	25.1	14.2	17.0	142.2
All hardwoods	380.2	421.9	983.9	326.5	383.4	547.6	352.3	454.1	3,849.9
All species	442.2	548.6	1,419.7	388.9	480.0	639.2	428.3	580.8	4,927.7

[a] International 1/4-inch rule.

Dickson, David R., and Teresa M. Bowers.
1976. **Forest statistics for Connecticut.** Northeast. For. Exp. Stn., Upper Darby, Pa.
40p. (USDA For. Serv. Resour. Bull. NE-44)

A report on the second inventory of the forest resources of Connecticut, including trends of change in commercial forest land acreage, volume of growing stock, and sawtimber volume. The report contains 32 tables of statistical data on forest land; timber volume; annual growth, removals, and mortality; and output of timber products.

(746)--905.2

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PULPWOOD PRODUCTION IN THE NORTHEAST — 1975

by James T. Bones and David R. Dickson

USDA FOREST SERVICE RESOURCE BULLETIN NE-45
1976

NORTHEASTERN FOREST EXPERIMENT STATION
FOREST SERVICE, U.S. DEPARTMENT OF AGRICULTURE
6816 MARKET STREET, UPPER DARBY, PA. 19082

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MANUSCRIPT RECEIVED FOR PUBLICATION 7 SEPTEMBER 1976

COVER PHOTO. A major obstacle to the acceptance of total-tree chips in some softwood regions has been the unacceptable amount of dirt introduced into the pulpmill with the chips. To cut down on the amount of dirt that is picked up from ground-yarding, some northeastern timber companies have been testing total-tree forwarders. The feller-forwarder in the picture was tested recently in Maine. This highly efficient type of harvester shears trees, loads them onto an integral dumping bunk, and moves a 50,000-pound payload to the landing. (**Cover photo credit:** Koehring Canada Limited)

BACKGROUND

THIS ANNUAL REPORT is based on a canvass of all pulpmills in the Northeast that use wood—either roundwood or plant residues—as a basic raw material for a variety of products. Cross-boundary shipments are traced by exchanging information with neighboring experiment stations that conduct similar canvasses. Mills that use pulpwood as a raw material in producing insulation board and hardboard were also included in the canvass.

The statistics for production from roundwood reported in this bulletin are based upon mill receipts, which are subject to fluctuations caused by uneven wood-inventory buildups or liquidations from year to year. The plant residues are received at the pulpmill mostly in chip form. Origins of mill receipts of pulpwood from roundwood are reported by county where harvested. However, pulpwood from plant residues can be traced only to the state where it was produced. Some of the logs from which the residues came were probably harvested in states other than the one in which they were processed.

1975 in Retrospect

The roller-coaster-like drop in demand for pulp and paper products (and for pulpwood) that began in the second half of 1974 carried into 1975. The slump in both pulpwood consumption and receipts at northeastern mills continued until July. Then in August, an influx in new orders for paper and paperboard triggered increased pulpmill operating rates. Woodyard inventories, which had been shrinking during the first half of 1975, had finally reached normal levels; and wood-procurement foresters began to encourage their wood suppliers to produce more pulpwood.

During the economic slowdown, most northeastern woodpulp producers carefully reviewed existing wood costs and sources as part of their efforts to lower operating costs. Dependable producers of high-quality chips from manufacturing residues are probably the most desirable source of wood for northeastern pulpmills. These chips are relatively clean and bark-free, and they require no additional processing at the pulpmill. For this reason more than one sawmill owner commented that the only market that held up during the recent economic slowdown was the pulp chip market.

Those northeastern pulpmills that have used total-tree chips as a raw material and found them to be satisfactory (did not lower product quality or affect mill maintenance) are increasing their usage because of the huge savings in harvesting and transportation costs that they are realizing.

Although some expansion of existing production facilities has been under way, pulp and paper manufacturers still cannot justify the construction of new pulpmills in our current economic climate. An article in the June issue of FORTUNE magazine details the industry's dilemna. (Weaver, Paul H., 1976. The papermakers are growing less and enjoying it more. Fortune Mag. 91(6): 156-162, 164, 167.) Because new mills are uneconomic, some major corporations are seeking to add to their productive capacity through acquisitions. Several pulpmills in the Northeast have held negotiations with these large corporations, and a few mergers have resulted (fig. 1 and mill list).

The one bright spot on the horizon at year end 1974 faded into the sunset as plans for the establishment of a 600-ton-per-day bleached hardwood kraft pulpmill in the upper Connecticut River Valley were shelved in favor of an alternative project in Alabama.

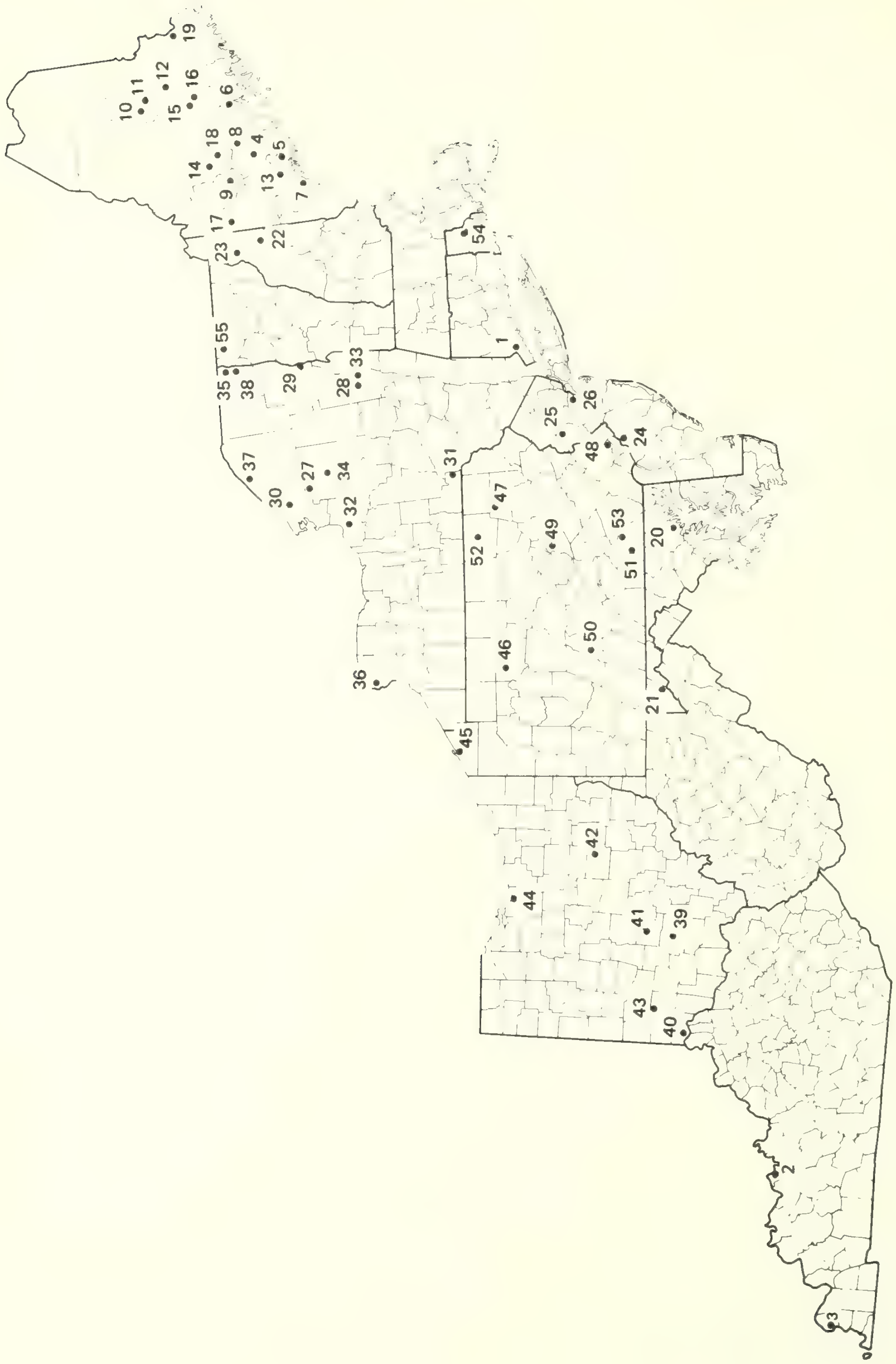


Figure 1.—Operating woodpulp mills in the Northeast, 1975.

OPERATING WOODPULP MILLS IN THE NORTHEAST, 1975

Number	Mill name and location	Capacity (tons/24 hrs)
	CONNECTICUT	
1	Tilo Company, Strafford	35
	KENTUCKY	
*2	Wescor and Western Kraft, Hawesville	550
3	Westvaco, Wickliffe	600
	MAINE	
4	Statler Tissue Co., Augusta	270
5	Pejepscot Paper Co., Brunswick	115
*6	St. Regis Paper Co., Bucksport	525
7	Scott Paper Co., Cumberland Falls	300
8	Scott Paper Co., Skowhegan	750
*9	International Paper Co., Jay	775
*10	Great Northern Nekoosa Corp., Millinocket	1,375
11	Great Northern Nekoosa Corp., E. Millinocket	920
12	Permoid Corp., Lincoln	360
13	U.S. Gypsum, Lisbon Falls	100
14	Penntech Papers Inc., Madison	150
15	Lily Tulip Corp., Old Town	50
*16	Diamond International Corp., Old Town	750
*17	Boise Cascade Corp., Rumford	670
18	Keyes Fibre Co., Shawnut	105
*19	Georgia Pacific Corp., Woodland	1,037
	MARYLAND	
20	Congoleum Industries, Finksburg	45
21	Westvaco, Luke	789
	NEW HAMPSHIRE	
*22	Brown Co., Berlin	975
23	Diamond International Corp., Groveton	250
	NEW JERSEY	
24	GAF Corp., Gloucester City	192
25	Johns-Manville Products Corp., Manville	100
26	Celotex Corp., Perth Amboy	100
	NEW YORK	
27	Latex Fiber Industries, Beaver Falls	70
28	International Paper Co., Corinth	255
29	International Paper Co., Ticonderoga	500
30	St. Regis Paper Co., Deferiet	240
31	Celotex Corp., Deposit	300
32	Armstrong Cork Co., Fulton	130
33	Finch Pruyn Co., Glen Falls	350
34	Georgia Pacific Corp., Lyons Falls	120
35	Georgia Pacific Corp., Plattsburgh	100
36	Nitec Paper Corp., Niagara Falls	100
37	Diamond International Corp., Ogdensburg	110
38	Diamond International Corp., Plattsburgh	50
	OHIO	
39	Mead Corp., Chillicothe	600
40	Celotex Corp., Cincinnati	100
41	Container Corp. of America, Circleville	300
42	Stone Container Corp., Coshocton	650
43	Bird and Son, Inc., Franklin	80
44	Certain-Teed Products Corp., Milan	90
	PENNSYLVANIA	
45	Hammermill Paper Co., Erie	700
46	Penntech Papers Inc., Johnsonburg	190
47	Charmin Paper Products Co., Mehoopany	(a)
48	Celotex Corp., Philadelphia	160
49	Celotex Corp., Sunbury	240
50	Appleton Papers, Inc., Roaring Springs	180
51	P. H. Glatfelter Co., Spring Grove	525
52	Masonite Corp., Towanda	280
53	Certain-Teed Products Corp., York	80
	RHODE ISLAND	
54	Bird and Son, Inc., Phillipdale	275
	VERMONT	
55	Saxon Industries, Sheldon Springs	50

* More than one pulpmill operating.

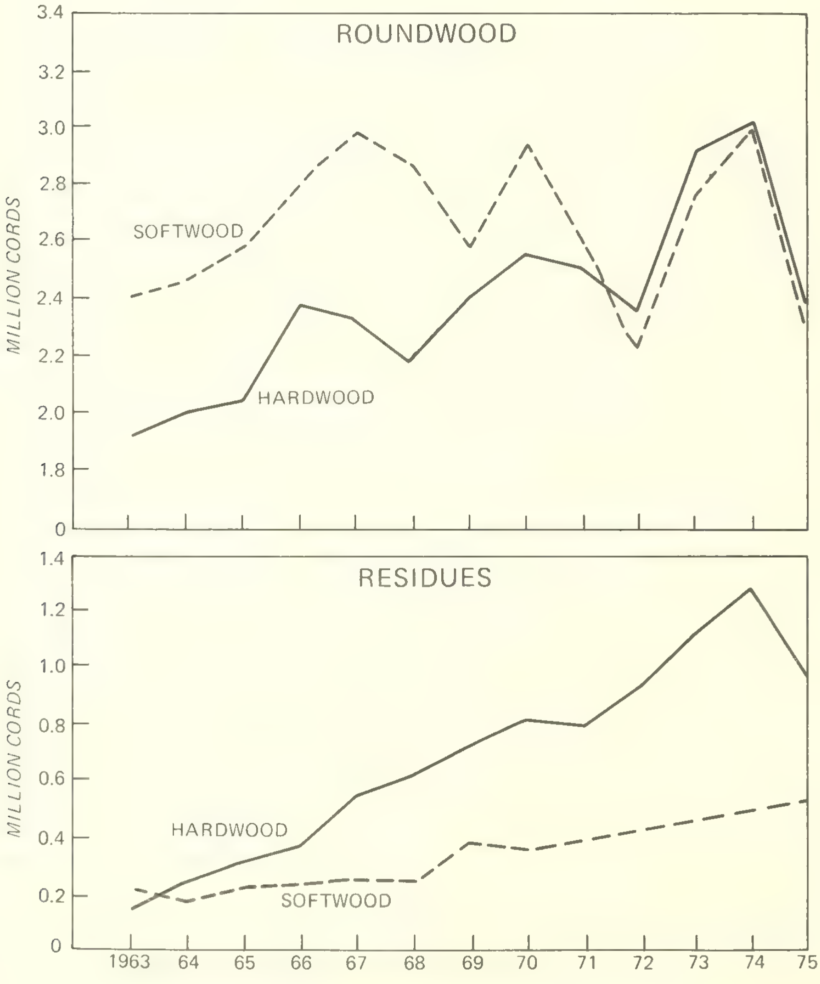
[a] Unknown.

Pulpwood Production Follows the Economy Down

The 6,109,600 cords of pulpwood produced in the 14 northeastern states (Connecticut, Delaware, Kentucky, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, West Virginia) in 1975 represented a decrease of 21 percent from the 7,760,600 cords reported in 1974, and the lowest output level since 1972 when total production dropped below 6 million cords. Year-to-year production decreases were registered for both softwood and hardwood roundwood and for hardwood chips (fig. 2). Softwood chip production from manufacturing residues continued the incremental increase that it has been achieving since 1970. This was the only component of the production total to increase.

Woodyard inventories at northeastern pulpmills continued to build into the spring of 1975 when pulpmill operators began a drastic curtailment of roundwood receipts. By August woodpulp demand had picked up sufficiently to encourage higher pulpmill operating levels, which in turn increased pulpwood consumption. By year end, pulpwood consumption was outstripping woodyard receipts and pulpwood inventories were dropping to normal levels.

Figure 2.—Pulpwood production for Northeastern States, by years and sources of wood.



Roundwood pulpwood production from hardwoods was almost equal to that of softwoods, exceeding it by only 15,700 cords. Although roundwood production dropped 23 percent from 1974, chipped residue production dropped only 16 percent. Hardwoods accounted for 53 percent of all pulpwood produced in 1975, down about 2 percentage points from 1974.

Receipts of pulpwood at woodpulp mills in the Northeast totaled 6,660,400 cords in 1975, down 21 percent from 1974. These receipts included wood harvested in the Northeast and pulpwood imported from other regions. Hardwood receipts exceeded those of softwoods by 297,000 cords. Total receipts exceeded total production by 550,800 cords (table 2).

Five of the 14 states (Connecticut, Delaware, Massachusetts, Vermont, and West Virginia) produced more wood than they received. Delaware, Massachusetts, and West Virginia had no operating woodpulp mills. Vermont and Connecticut each had one. Pulpwood production increased between 1974 and 1975 in only one of the 14 Northeastern States. Massachusetts experienced a 27-percent increase between years. Production declines of more than 25 percent were experienced in New York, New Jersey, Kentucky, and Ohio. Declines in pulpwood receipts of 25 percent or more over 1974 levels were registered in New Jersey, New York, and Ohio. Maryland reported a 5-percent increase in receipts between years.

In previous years, a major portion of the northeastern requirement for pulpwood was satisfied by shipments of Canadian softwood into the Northeast. This trend has been changing as more southern pulpwood has been finding its way into northern woodyards and as pulpmills continue to use larger quantities of hardwood. In 1975, about 47 percent of the roundwood shipments into the Northeast came from Canada, and 48 percent came from the southern states. The remaining 5 percent came from the Lake States and Central States. Although softwood roundwood imports exceeded hardwood imports in 1975, hardwood chip imports exceeded softwood imports by more than 2 to 1.

Production From Roundwood Down 23 Percent

The production of pulpwood from roundwood decreased 1,364,000 cords—a 23-percent decline from 1974. The 4,638,700 cords of roundwood produced in 1975 represents the lowest production level attained since 1972, when much of the pulpwood production in the Northeast shifted from roundwood to increased chipped-residue use.

The 1975 pulpwood production from roundwood was down from 1974 in 13 of the 14 states. West Virginia was the only state that registered a production increase—up 27 percent over 1974. Production decreases of 25 percent or more were recorded in Kentucky, Maine, New Jersey, and Ohio. Maine, which accounts for 54 percent of the roundwood harvest in the Northeast, registered a 26-percent decline in production between 1974 and 1975.

Thirteen Counties Top 50-Thousand-Cord Mark

Thirteen counties in five states produced more than 50,000 cords of pulpwood from roundwood in 1975. This is a decrease of seven counties from the 1974 level, and it equals the previous low that was reached in 1972. The 2.7 million cords of roundwood harvested from these counties represents 58 percent of the total roundwood harvest in the Northeast.

A drop in the harvesting levels in New York was responsible for four of the five counties listed in 1974 to be dropped from this year's list of high-production counties. New Hampshire, Vermont, New York, and West Virginia each had single representatives. Pennsylvania did not have a high-producing county this year. As in previous years, Maine counties dominated the list of 13 counties. Counties that produced more than 50,000 cords of pulpwood from roundwood in 1975 and their production totals are:

County	*Production (thousand cords)*
Piscataquis, Maine	451.7
Aroostook, Maine	369.1
Washington, Maine	365.8
Somerset, Maine	331.0
Penobscot, Maine	313.5
Oxford, Maine	212.3
Coos, New Hampshire	171.1
Franklin, Maine	130.0
Grant, West Virginia	123.7
Essex, Vermont	86.2
Hancock, Maine	55.8
Hamilton, New York	50.8
Kennebec, Maine	50.4

Roundwood Harvest as Related to Growing-Stock Inventory

Although figures 3, 4, and 5 show the total roundwood harvest by production class and county in the Northeast, these figures do not relate the volume harvested to the volume of growing-stock trees that are actually present. Growing-stock volume is net volume in cubic feet of sound live trees of commercial species that are 5.0 inches dbh or larger, from a 1-foot stump to a minimum 4.0-inch top diameter outside bark of the central bole, or to the point where the bole breaks into limbs. The growing-stock volumes by species group and states that are used for making this comparison are based on those compiled for the 1970 National Timber Review.

The following tabulation of harvesting intensity shows the volume of growing stock present per unit harvested—by state and species group—in thousand cubic feet of growing stock present for each cord of pulpwood harvested in 1975:

Softwood

Maryland	5.1
Delaware	7.2
Maine	8.5
Average	12.0
West Virginia	12.9
New Jersey	17.6
New York	18.4
Vermont	21.1
Rhode Island	28.4
Ohio	28.8
New Hampshire	51.3
Kentucky	51.8
Pennsylvania	54.2
Connecticut	67.1
Massachusetts	108.4

Hardwood

Maine	8.6
New Hampshire	13.3
Ohio	22.3
Vermont	25.9
Average	31.2
New York	33.8
Pennsylvania	36.6
Maryland	41.6
West Virginia	60.7
Delaware	83.9
Rhode Island	91.4
Kentucky	151.8
Connecticut	696.0
Massachusetts	885.0
New Jersey	1,343.7

The states have been ranked (top to bottom) from the state in which the roundwood harvest was most intensive to the state in which the harvest was least intensive. These rankings and the regional averages should not be viewed as an index or standard for harvesting, but simply as a means of directing individuals engaged in pulpwood procurement from several alternative areas toward the most promising one.

For each cord of pulpwood harvested in the Northeast in 1975, there were 12,000 cubic feet of softwood growing stock and 31,200 cubic feet of hardwood growing stock. The softwood harvest was more intensive than the regional average in Maryland, Delaware, and Maine. The hardwood harvest was more intensive than the regional average in Maine, New Hampshire, Ohio, and Vermont. Harvesting intensity was relatively low in the more urban states of the Northeast.

Wood Chip Production Decreases 16 Percent

The production of wood chips and sawdust from plant residues for use as woodpulp decreased 16 percent from the 1,757,900 cord equivalents produced in 1974. In the first half of the year, low primary wood-manufacturing rates that curtailed coarse plant-residue production accounted for the decrease in pulp-chip availability. Hardwood-producing regions of the Northeast were particularly hard hit by the Nation's economic slowdown and were slower to recover in the improving economy. Softwood pulp-chip production actually increased 7 percent between 1974 and 1975.

Pulpwood chip production by states in 1974 and 1975 are compared in the following tabulation:

	1974 (thousand cord equivalents)	*1975 (thousand cord equivalents)*	*Change (percent)*
Connecticut	2.4	2.2	-8
Delaware	—	—	([a])
Kentucky	263.3	193.3	-27
Maine	336.6	374.9	+11
Maryland	107.9	100.9	-6
Massachusetts	18.8	29.9	+59
New Hampshire	139.1	120.3	-14
New Jersey	6.2	7.6	+23
New York	200.0	124.1	-38
Ohio	115.6	93.4	-19
Pennsylvania	308.8	244.1	-21
Rhode Island	(*)	(*)	([a])
Vermont	60.7	44.5	-27
West Virginia	198.5	135.7	-32
Total	1,757.9	1,470.9	-16

(*) Less than 50 cord equivalents.

[a] Little or no production in 1975.

Chip production was up in three states—Massachusetts, New Jersey, and Maine. The highest absolute volume gain (38,800 cord equivalents) was made by Maine, an important softwood-using state. The highest percentage production gain (59 percent) was made in Massachusetts. The 1975 production of chips and sawdust from plant residues accounted for 24 percent of the northeastern pulpwood production total, up one percentage point from 1974. Chip production for softwoods in 1975 stands at an all-time record level.

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Table 1.—Total production of pulpwood in the Northeast, by source and state, 1975

[In thousands of rough cords] [a]

State	Source		
	From roundwood	From plant residues	From all sources
Connecticut	5.8	2.2	8.0
Delaware	36.9	—	36.9
Kentucky	64.2	193.3	257.5
Maine	2,491.9	374.9	2,866.8
Maryland	165.2	100.9	266.1
Massachusetts	9.3	29.9	39.2
New Hampshire	225.5	120.3	345.8
New Jersey	22.9	7.6	30.5
New York	451.9	124.1	576.0
Ohio	185.7	93.4	279.1
Pennsylvania	539.0	244.1	783.1
Rhode Island	3.4	(*)	3.4
Vermont	165.0	44.5	209.5
West Virginia	272.0	135.7	407.7
All states	4,638.7	1,470.9	6,109.6

[a] 128 cubic feet of wood, bark, and air space.

* Less than 50 cord equivalents.

Table 2.—Total production and receipts of pulpwood in the Northeast, by state and species group, 1975

[In thousands of rough cords]

State	Total production		Total receipts		Production surplus (+) or deficit (-)
	Softwood	Hardwood	Softwood	Hardwood	
Connecticut	4.5	3.5	(D)	(D)	+(D)
Delaware	31.8	5.1	—	—	+36.9
Kentucky	18.6	238.9	127.8	439.8	-310.1
Maine	2,030.9	835.9	2,307.0	856.9	-297.1
Maryland	159.8	106.3	140.2	353.9	-228.0
Massachusetts	24.5	14.7	—	—	+39.2
New Hampshire	146.8	199.0	84.1	351.3	-89.6
New Jersey	27.3	3.2	38.0	7.7	-15.2
New York	204.3	371.7	288.1	339.8	-51.9
Ohio	7.3	271.8	6.8	362.1	-89.8
Pennsylvania	41.7	741.4	161.3	758.7	-136.9
Rhode Island	.7	2.7	(D)	(D)	-(D)
Vermont	91.4	118.1	(D)	(D)	+(D)
West Virginia	53.5	354.2	—	—	+407.7
All states	2,843.1	3,266.5	3,181.7	3,478.7	-550.8

(D) Data withheld to avoid disclosure for individual mills.

Table 3.—Pulpwood production from roundwood in the Northeast, by state and species group and destination of shipments, 1975

[In thousands of rough cords]

State	Softwood				Hardwood				Total production
	Cut and retained in state	Shipped to other states		Total softwood	Cut and retained in state	Shipped to other states		Total hardwood	
		In Northeast	Outside Northeast			In Northeast	Outside Northeast		
Connecticut	2.4	1.0	—	3.4	—	2.4	—	2.4	5.8
Delaware	—	10.7	21.1	31.8	—	4.0	1.1	5.1	36.9
Kentucky	(*)	—	12.0	12.0	28.8	14.2	9.2	52.2	64.2
Maine	1,720.3	16.1	2.1	1,738.5	700.6	52.8	—	753.4	2,491.9
Maryland	23.7	32.7	47.6	104.0	54.5	5.4	1.3	61.2	165.2
Massachusetts	—	7.1	—	7.1	—	2.2	—	2.2	9.3
New Hampshire	19.5	37.1	—	56.6	155.2	13.7	—	168.9	225.5
New Jersey	21.9	—	—	21.9	1.0	—	—	1.0	22.9
New York	176.5	2.8	—	179.3	234.6	18.4	19.6	272.6	451.9
Ohio	—	4.3	—	4.3	181.4	(*)	—	181.4	185.7
Pennsylvania	20.1	9.4	—	29.5	464.4	45.1	—	509.5	539.0
Rhode Island	.7	—	—	.7	2.7	—	—	2.7	3.4
Vermont	14.1	57.5	—	71.6	—	93.4	—	93.4	165.0
West Virginia	—	47.1	3.7	50.8	—	170.7	50.5	221.2	272.0
All states	1,999.2	225.8	86.5	2,311.5	1,823.2	422.3	81.7	2,327.2	4,638.7

* Less than 50 cords.

Table 4.—Pulpwood chip production from plant residues in the Northeast, by state and species group, 1975

[In thousands of rough cord equivalents]

State	Softwood				Hardwood				Total production
	Produced and retained in state	Shipped to other states		Total softwood	Produced and retained in state	Shipped to other states		Total hardwood	
		In Northeast	Outside Northeast			In Northeast	Outside Northeast		
Connecticut	—	1.1	—	1.1	—	1.1	—	1.1	2.2
Delaware	—	—	—	—	—	—	—	—	—
Kentucky	—	5.7	0.9	6.6	134.2	24.0	28.5	186.7	193.3
Maine	289.6	.4	2.4	292.4	72.9	9.6	—	82.5	374.9
Maryland	1.8	36.1	17.9	55.8	11.8	33.3	—	45.1	100.9
Massachusetts	—	17.4	—	17.4	—	12.5	—	12.5	29.9
New Hampshire	36.2	48.7	5.3	90.2	16.1	13.3	.7	30.1	120.3
New Jersey	3.8	1.6	—	5.4	—	2.2	—	2.2	7.6
New York	19.0	6.0	—	25.0	49.9	38.9	10.3	99.1	124.1
Ohio	—	3.0	—	3.0	87.3	3.1	—	90.4	93.4
Pennsylvania	10.5	1.7	—	12.2	187.5	44.4	—	231.9	244.1
Rhode Island	—	—	—	—	—	(*)	—	(*)	(*)
Vermont	—	19.8	—	19.8	—	24.7	—	24.7	44.5
West Virginia	—	.7	2.0	2.7	—	65.2	67.8	133.0	135.7
All states	360.9	142.2	28.5	531.6	559.7	272.3	107.3	939.3	1,470.9

*** Less than 50 cord equivalents.**

Table 5.—Pulpwood receipts from roundwood in the Northeast, by state and species group, 1975

[In thousands of rough cords]

State[a]	Softwood				Hardwood				Total receipts
	Cut and retained in state	Receipts from other states		Total softwood	Cut and retained in state	Receipts from other states		Total hardwood	
		In Northeast	Outside Northeast			In Northeast	Outside Northeast		
Connecticut	2.4	(D)	(D)	(D)	—	(D)	(D)	(D)	(D)
Kentucky	(*)	—	102.4	102.4	28.8	—	90.8	119.6	222.0
Maine	1,720.3	23.0	167.9	1,911.2	700.6	12.7	55.4	768.7	2,679.9
Maryland	23.7	57.4	36.1	117.2	54.5	202.5	8.0	265.0	382.2
New Hampshire	19.5	21.4	.1	41.0	155.2	135.8	20.6	311.6	352.6
New Jersey	21.9	—	—	21.9	1.0	—	—	1.0	22.9
New York	176.5	66.0	2.9	245.4	234.6	13.8	1.3	249.7	495.1
Ohio	—	—	—	—	181.4	21.6	3.6	206.6	206.6
Pennsylvania	20.1	49.7	41.9	111.7	464.4	30.1	1.7	496.2	607.9
Rhode Island	.7	(D)	(D)	(D)	2.7	(D)	(D)	(D)	(D)
Vermont	14.1	(D)	(D)	(D)	—	(D)	(D)	(D)	(D)
All states	1,999.2	226.0	352.7	2,577.9	1,832.2	422.0	181.4	2,426.6	5,004.5

[a] States with no pulpmills are omitted.
(D) Data withheld to avoid disclosure for individual mills.
* Less than 50 cords.

Table 6.—Pulpwood chip receipts from plant residues in the Northeast, by state and species group, 1975[a]

[In thousands of rough cord equivalents]

State[b]	Softwood				Hardwood				Total receipts
	Produced and retained in state	Receipts from other states		Total softwood	Produced and retained in state	Receipts from other states		Total hardwood	
		In Northeast	Outside Northeast			In Northeast	Outside Northeast		
Connecticut	—	(D)	(D)	(D)	—	(D)	(D)	(D)	(D)
Kentucky	—	—	25.4	25.4	134.2	—	186.0	320.2	345.6
Maine	289.6	58.1	48.1	395.8	72.9	14.2	1.1	88.2	484.0
Maryland	1.8	2.0	19.2	23.0	11.8	71.7	5.4	88.9	111.9
New Hampshire	36.2	5.8	1.1	43.1	16.1	17.0	6.6	39.7	82.8
New Jersey	3.8	10.8	1.5	16.1	—	6.7	—	6.7	22.8
New York	19.0	23.7	—	42.7	49.9	35.0	5.2	90.1	132.8
Ohio	—	5.9	.9	6.8	87.3	58.7	9.5	155.5	162.3
Pennsylvania	10.5	34.6	4.5	49.6	187.5	69.0	6.0	262.5	312.1
Rhode Island	—	(D)	(D)	(D)	—	(D)	(D)	(D)	(D)
Vermont	—	(D)	(D)	(D)	—	(D)	(D)	(D)	(D)
All states	360.9	142.2	100.7	603.8	559.7	272.6	219.8	1,052.1	1,655.9

[a] Includes sawmill slabs and edgings, sawdust, veneer cores, and post and pole trimmings.
[b] States with no pulpmills are omitted.
(D) Data withheld to avoid disclosure for individual mills.

Table 7.—Pulpwood from roundwood received from states outside the Northeast, by state or province of origin and species group, 1975

[In thousands of rough cords]

Receiving state[a]	State or province of origin	Total softwood	Total hardwood	All species
Kentucky	Illinois	0.1	12.0	12.1
	Indiana	—	12.5	12.5
	Mississippi	94.3	44.8	139.1
	Missouri	(*)	7.5	7.5
	Tennessee	8.0	14.0	22.0
Maine	New Brunswick	160.6	54.5	215.1
	Quebec	7.3	.9	8.2
Maryland	Virginia	36.1	8.0	44.1
New Hampshire	Quebec	.1	20.6	20.7
New York	Ontario	1.1	1.3	2.4
	Quebec	1.8	(*)	1.8
Ohio	Indiana	—	1.0	1.0
	Iowa	—	2.6	2.6
Pennsylvania	Virginia	41.9	1.7	43.6
Vermont	Quebec	1.4	—	1.4
All states	—	352.7	181.4	534.1

[a] States with no receipts are omitted.

* Less than 50 cords.

Table 8.—Pulpwood chip receipts from wood-using plants outside the Northeast, by state or province of origin and species group, 1975

[In thousands of rough cord equivalents]

Receiving state[a]	State or province of origin	Total softwood	Total hardwood	All species
Kentucky	Alabama	—	2.3	2.3
	Illinois	2.6	27.8	30.4
	Indiana	—	42.3	42.3
	Mississippi	22.8	16.1	38.9
	Missouri	—	62.5	62.5
	Tennessee	—	35.0	35.0
Maine	New Brunswick	6.0	1.0	7.0
	Quebec	42.1	.1	42.2
Maryland	Virginia	19.2	5.4	24.6
New Hampshire	Quebec	1.1	6.6	7.7
New Jersey	Virginia	1.5	—	1.5
New York	Ontario	—	4.9	4.9
	Quebec	—	.3	.3
Ohio	Indiana	—	7.3	7.3
	Virginia	.9	2.2	3.1
Pennsylvania	Virginia	4.5	6.0	10.5
All states	—	100.7	219.8	320.5

[a] States with no receipts are omitted.

Table 9.—Pulpwood production from roundwood in the Northeast, by state and species group, 1975

[In thousands of rough cords]

State	Softwood				Hardwood				All species
	Spruce and fir	Hemlock and tamarack	Pine	Total	Aspen and yellow-poplar	Oak and hickory	Other hardwoods	Total	
Connecticut	—	—	3.4	3.4	—	1.1	1.3	2.4	5.8
Delaware	—	—	31.8	31.8	—	3.3	1.8	5.1	36.9
Kentucky	—	(*)	12.0	12.0	4.9	24.9	22.4	52.2	64.2
Maine	1,417.3	166.4	154.8	1,738.5	66.3	25.4	661.7	753.4	2,491.9
Maryland	.7	2.2	101.1	104.0	—	26.6	34.6	61.2	165.2
Massachusetts	—	—	7.1	7.1	—	1.0	1.2	2.2	9.3
New Hampshire	37.8	3.5	15.3	56.6	12.7	1.1	155.1	168.9	225.5
New Jersey	—	—	21.9	21.9	—	1.0	—	1.0	22.9
New York	77.9	28.1	73.3	179.3	26.6	6.9	239.1	272.6	451.9
Ohio	—	—	4.3	4.3	13.5	86.3	81.6	181.4	185.7
Pennsylvania	—	2.0	27.5	29.5	31.8	193.5	284.2	509.5	539.0
Rhode Island	—	—	.7	.7	—	1.2	1.5	2.7	3.4
Vermont	59.7	3.0	8.9	71.6	7.4	.6	85.4	93.4	165.0
West Virginia	0.3	3.2	47.3	50.8	(*)	130.5	90.7	221.2	272.0
All states	1,593.7	208.4	509.4	2,311.5	163.2	503.4	1,660.6	2,327.2	4,638.7

(*) Less than 50 cords.

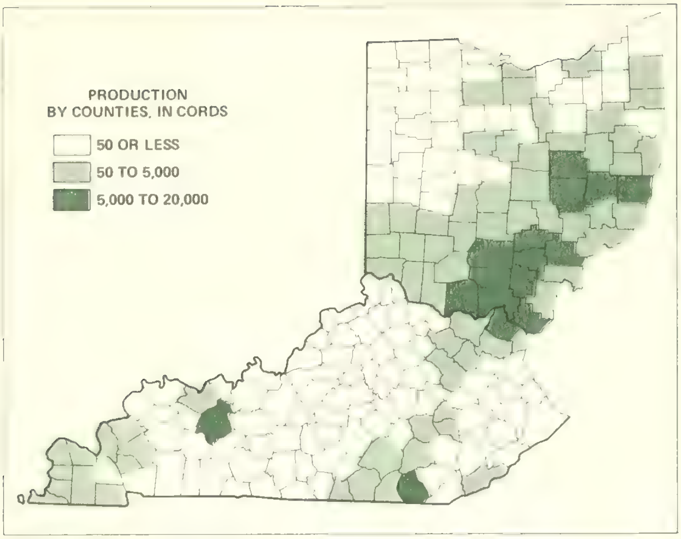

Figure 3.—Geographical pattern of pulpwood production from roundwood in Kentucky and Ohio by counties and species groups, 1975

Table 10.—Pulpwood production from roundwood in Kentucky and Ohio, by state and county and species group, 1975

[In thousands of rough cords]

County [a]	Softwood				Hardwood				All species
	Spruce and fir	Hemlock and tamarack	Pine	Total	Aspen and yellow-poplar	Oak and hickory	Other hardwoods	Total	
KENTUCKY									
Ballard	—	—	—	—	1.0	2.2	1.7	4.9	4.9
Bath	—	—	1.0	1.0	—	.5	.3	.8	1.8
Boyd	—	—	—	—	(*)	.3	(*)	.3	.3
Breathitt	—	—	(*)	(*)	—	(*)	(*)	(*)	(*)
Caldwell	—	—	—	—	.1	.3	.3	.7	.7
Calloway	—	—	—	—	.1	.2	.3	.6	.6
Carlisle	—	—	—	—	.7	1.5	1.1	3.3	3.3
Carter	—	—	.1	.1	.1	.8	.1	1.0	1.1
Christian	—	—	—	—	—	(*)	(*)	(*)	(*)
Clinton	—	—	—	—	—	1.3	.4	1.7	1.7
Crittenden	—	—	—	—	.1	.3	.2	.6	.6
Daviess	—	—	—	—	—	—	1.3	1.3	1.3
Elliott	—	—	(*)	(*)	—	—	(*)	(*)	(*)
Fleming	—	—	(*)	(*)	(*)	.2	(*)	.2	.2
Floyd	—	—	—	—	—	—	(*)	(*)	(*)
Fulton	—	—	—	—	.2	.6	.4	1.2	1.2
Graves	—	—	—	—	.7	1.5	1.2	3.4	3.4
Greenup	—	—	(*)	(*)	.6	6.8	.9	8.3	8.3
Harlan	—	—	—	—	—	—	1.6	1.6	1.6
Hickman	—	—	—	—	.3	.7	.6	1.6	1.6
Jackson	—	—	.1	.1	—	(*)	(*)	(*)	.1
Laurel	—	—	1.4	1.4	—	—	—	—	1.4
Lee	—	—	.4	.4	—	.3	.2	.5	.9
Lewis	—	—	—	—	.3	3.6	.6	4.5	4.5
Livingston	—	—	—	—	.1	.3	.2	.6	.6
Lyon	—	—	.1	.1	.2	.3	.3	.8	.9
McCracken	—	—	—	—	.4	.9	.7	2.0	2.0
McCreary	—	—	2.1	2.1	—	.4	.9	1.3	3.4
Marshall	—	—	—	—	—	—	(*)	(*)	(*)
Menifee	—	—	.5	.5	(*)	.2	.1	.3	.8
Montgomery	—	—	(*)	(*)	—	(*)	(*)	(*)	(*)

Table 10.— Continued

County[a]	Softwood				Hardwood				All species
	Spruce and fir	Hemlock and tamarack	Pine	Total	Aspen and yellow-poplar	Oak and hickory	Other hardwoods	Total	
Ohio	—	—	—	—	—	—	8.2	8.2	8.2
Owsley	—	—	.1	.1	—	.1	(*)	.1	.2
Perry	—	—	—	—	—	—	(*)	(*)	(*)
Pulaski	—	(*)	—	(*)	—	—	.2	.2	.2
Rowan	—	—	(*)	(*)	(*)	.3	.1	.4	.4
Wayne	—	—	.2	.2	—	.8	.2	1.0	1.2
Whitley	—	—	6.0	6.0	—	.5	.3	.8	6.8
Wolfe	—	—	(*)	(*)	—	—	—	—	(*)
Total	—	(*)	12.0	12.0	4.9	24.9	22.4	52.2	64.2
					OHIO				
Adams	—	—	—	—	1.3	4.9	1.9	8.1	8.1
Ashland	—	—	—	—	—	(*)	.2	.2	.2
Athens	—	—	—	—	1.0	1.7	3.7	6.4	6.4
Belmont	—	—	—	—	—	—	9.6	9.6	9.6
Brown	—	—	—	—	(*)	.5	.1	.6	.6
Butler	—	—	—	—	—	—	.4	.4	.4
Carroll	—	—	—	—	—	—	3.8	3.8	3.8
Clermont	—	—	—	—	—	—	.4	.4	.4
Clinton	—	—	—	—	.2	2.8	1.4	4.4	4.4
Coshocton	—	—	—	—	—	—	7.7	7.7	7.7
Cuyahoga	—	—	—	—	—	—	.2	.2	.2
Erie	—	—	—	—	—	.3	.2	.5	.5
Fairfield	—	—	—	—	.5	.8	.5	1.8	1.8
Fayette	—	—	—	—	(*)	.1	(*)	.1	.1
Franklin	—	—	—	—	.1	.1	(*)	.2	.2
Gallia	—	—	1.0	1.0	.2	2.3	.3	2.8	3.8
Greene	—	—	—	—	—	—	.3	.3	.3
Guernsey	—	—	—	—	—	—	5.8	5.8	5.8
Hamilton	—	—	—	—	—	—	.1	.1	.1
Harrison	—	—	—	—	—	—	1.2	1.2	1.2
Highland	—	—	—	—	.1	1.0	.5	1.6	1.6
Hocking	—	—	—	—	1.5	4.1	1.7	7.3	7.3
Holmes	—	—	—	—	—	—	1.5	1.5	1.5
Huron	—	—	—	—	—	.4	.4	.8	.8
Jackson	—	—	.2	.2	.7	9.2	1.8	11.7	11.9
Jefferson	—	—	(*)	(*)	—	—	.4	.4	.4
Knox	—	—	—	—	—	—	1.2	1.2	1.2
Lawrence	—	—	.5	.5	.8	7.0	1.2	9.0	9.5
Licking	—	—	—	—	—	—	.8	.8	.8
Logan	—	—	—	—	(*)	(*)	(*)	(*)	(*)
Madison	—	—	—	—	.4	.7	.5	1.6	1.6
Mahoning	—	—	1.5	1.5	—	—	—	—	1.5
Marion	—	—	—	—	(*)	.1	(*)	.1	.1
Meigs	—	—	.7	.7	.1	.3	.1	.5	1.2
Mercer	—	—	—	—	(*)	(*)	(*)	(*)	(*)
Monroe	—	—	—	—	—	—	.8	.8	.8
Montgomery	—	—	—	—	—	—	.4	.4	.4
Morgan	—	—	—	—	—	—	4.2	4.2	4.2
Morrow	—	—	—	—	(*)	(*)	.4	.4	.4
Muskinghum	—	—	—	—	—	—	9.2	9.2	9.2
Noble	—	—	—	—	—	—	2.7	2.7	2.7
Perry	—	—	—	—	.1	.1	2.4	2.6	2.6
Pickaway	—	—	—	—	1.0	2.7	1.1	4.8	4.8
Pike	—	—	—	—	.9	10.0	1.3	12.2	12.2
Preble	—	—	—	—	—	—	.2	.2	.2
Ross	—	—	—	—	1.0	12.5	1.9	15.4	15.4
Scioto	—	—	—	—	1.0	7.4	1.3	9.7	9.7
Seneca	—	—	—	—	—	.1	.1	.2	.2
Stark	—	—	—	—	—	—	.4	.4	.4
Trumbull	—	—	.4	.4	—	—	—	—	.4
Tuscarawas	—	—	—	—	—	—	2.7	2.7	2.7
Vinton	—	—	(*)	(*)	2.6	17.2	3.6	23.4	23.4
Warren	—	—	—	—	—	—	.6	.6	.6
Washington	—	—	—	—	—	—	.4	.4	.4
Total	—	—	4.3	4.3	13.5	86.3	81.6	181.4	185.7

[a] Counties with no production are omitted.

* Less than 50 cords.

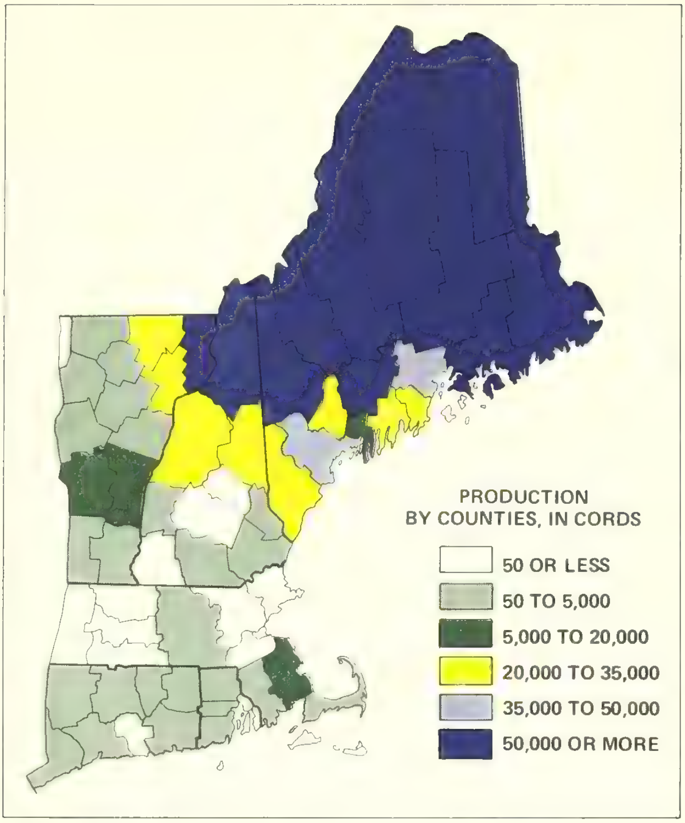

Figure 4.—Geographical pattern of pulpwood production from roundwood in the New England States, 1975.

Table 11.—Pulpwood production from roundwood in Southern New England, by state and county and species group, 1975

[In thousands of rough cords]

County [a]	Softwood				Hardwood				All species
	Spruce and fir	Hemlock and tamarack	Pine	Total	Aspen and yellow-poplar	Oak and hickory	Other hardwoods	Total	
				CONNECTICUT					
Fairfield	—	—	0.6	0.6	—	—	—	—	0.6
Hartford	—	—	.2	.2	—	—	—	—	.2
Litchfield	—	—	.1	.1	—	—	—	—	.1
New Haven	—	—	1.5	1.5	—	—	—	—	1.5
New London	—	—	.2	.2	—	0.2	0.2	0.4	.6
Tolland	—	—	.1	.1	—	.1	.1	.2	.3
Windham	—	—	.7	.6	—	.8	1.0	1.8	2.5
Total	—	—	3.4	3.4	—	1.1	1.3	2.4	5.8
				MASSACHUSETTS					
Barnstable	—	—	0.5	0.5	—	—	—	—	0.5
Bristol	—	—	1.2	1.2	—	0.4	0.5	0.9	2.1
Plymouth	—	—	4.9	4.9	—	.6	.7	1.3	6.2
Worcester	—	—	.5	.5	—	—	—	—	.5
Total	—	—	7.1	7.1	—	1.0	1.2	2.2	9.3
				RHODE ISLAND					
Kent	—	—	0.2	0.2	—	0.7	0.8	1.5	1.7
Providence	—	—	.3	.3	—	.3	.4	.7	1.0
Washington	—	—	.2	.2	—	.2	.3	.5	.7
Total	—	—	0.7	0.7	—	1.2	1.5	2.7	3.4

[a] Counties with no production are omitted.

Table 12.—Pulpwood production from roundwood in Northern New England, by state and county and species group, 1975

[In thousands of rough cords]

County [a]	Softwood				Hardwood				All species
	Spruce and fir	Hemlock and tamarack	Pine	Total	Aspen and yellow-poplar	Oak and hickory	Other hardwoods	Total	
MAINE									
Androscoggin	3.2	3.8	12.3	19.3	0.9	0.4	11.7	13.0	32.3
Aroostook	289.3	10.2	.1	299.6	15.4	2.0	52.1	69.5	369.1
Cumberland	2.7	2.3	18.5	23.5	1.0	.6	15.8	17.4	40.9
Franklin	39.8	5.9	4.0	49.7	7.3	2.7	70.3	80.3	130.0
Hancock	29.3	2.9	3.3	35.5	.5	.7	19.1	20.3	55.8
Kennebec	5.2	7.4	15.0	27.6	2.2	.8	19.8	22.8	50.4
Knox	7.4	2.9	7.6	17.9	.1	.3	6.8	7.2	25.1
Lincoln	4.5	4.5	12.0	21.0	.1	.4	10.8	11.3	32.3
Oxford	45.6	14.8	18.9	79.3	6.4	4.7	121.9	133.0	212.3
Penobscot	152.4	54.7	8.7	215.8	7.6	3.3	86.8	97.7	313.5
Piscataquis	360.4	7.7	2.4	370.5	2.3	2.9	76.0	81.2	451.7
Sagadahoc	2.9	1.6	7.2	11.7	.1	.2	4.1	4.4	16.1
Somerset	266.2	7.7	5.6	279.5	4.0	1.8	45.7	51.5	331.0
Waldo	11.4	4.2	11.0	26.6	1.1	.5	14.3	15.9	42.5
Washington	196.5	35.4	10.9	242.8	17.3	3.9	101.8	123.0	365.8
York	.5	.4	17.3	18.2	—	.2	4.7	4.9	23.1
Total	1,417.3	166.4	154.8	1,738.5	66.3	25.4	661.7	753.4	2,491.9
NEW HAMPSHIRE									
Belknap	—	—	—	—	—	—	(*)	(*)	(*)
Carroll	1.2	0.7	10.8	12.7	0.5	—	14.4	14.9	27.6
Coos	33.2	2.1	1.7	37.0	10.1	0.6	123.4	134.1	171.1
Grafton	1.6	.7	2.4	4.7	2.1	.4	16.4	18.9	23.6
Hillsborough	—	—	(*)	(*)	—	.1	.1	.2	.2
Merrimack	(*)	—	—	(*)	—	—	—	—	(*)
Rockingham	—	—	.3	.3	—	(*)	.2	.2	.5
Strafford	—	—	.1	.1	—	(*)	.6	.6	.7
Sullivan	1.8	(*)	(*)	1.8	(*)	—	(*)	(*)	1.8
Total	37.8	3.5	15.3	56.6	12.7	1.1	155.1	168.9	225.5
VERMONT									
Addison	0.2	0.2	1.2	1.6	0.1	0.1	1.0	1.2	2.8
Bennington	.8	—	.3	1.1	(*)	.1	3.4	3.5	4.6
Caledonia	12.4	.4	1.3	14.1	.8	.1	8.1	9.0	23.1
Chittenden	.2	(*)	1.4	1.6	.1	—	.8	.9	2.5
Essex	20.7	.5	.1	21.3	3.9	.2	60.8	64.9	86.2
Franklin	1.1	(*)	—	1.1	—	—	—	—	1.1
Lamoille	1.0	.3	(*)	1.3	—	(*)	.6	.6	1.9
Orange	—	.3	—	.3	—	—	—	—	.3
Orleans	11.9	.6	.3	12.8	.8	(*)	6.9	7.7	20.5
Rutland	2.2	.2	2.5	4.9	.8	(*)	2.0	2.8	7.7
Washington	3.6	—	.5	4.1	.3	—	—	.3	4.4
Windham	1.9	.3	.2	2.4	(*)	(*)	.9	.9	3.3
Windsor	3.7	.2	1.1	5.0	.6	.1	.9	1.6	6.6
Total	59.7	3.0	8.9	71.6	7.4	0.6	85.4	93.4	165.0

* Less than 50 cords.

[a] Counties with no production are omitted.

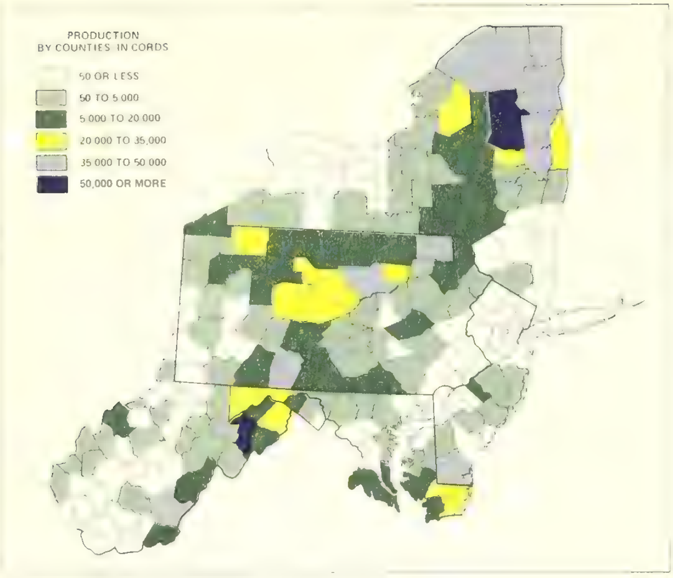

Figure 5.—Geographical pattern of pulpwood production from roundwood in the Middle Atlantic States, 1975.

Table 13.—Pulpwood production from roundwood in New York, by county and species group, 1975

[In thousands of rough cords]

County [a]	Softwood				Hardwood				All species
	Spruce and fir	Hemlock and tamarack	Pine	Total	Aspen and yellow-poplar	Oak and hickory	Other hardwoods	Total	
Albany	(*)	—	—	(*)	—	—	0.3	0.3	0.3
Broome	—	—	—	—	0.5	1.9	4.3	6.7	6.7
Cattaraugus	—	—	2.8	2.8	—	—	.6	.6	3.4
Cayuga	1.0	—	—	1.0	(*)	—	—	(*)	1.0
Chautauqua	—	—	—	—	—	—	.1	.1	.1
Chemung	—	—	—	—	.3	.9	1.2	2.4	2.4
Chenango	5.5	—	.2	5.7	.2	.3	1.3	1.8	7.5
Clinton	4.7	0.4	4.8	9.9	3.5	—	23.7	27.2	37.1
Cortland	1.0	—	.6	1.6	—	—	—	—	1.6
Delaware	.8	—	(*)	.8	(*)	.1	16.1	16.2	17.0
Essex	2.3	7.6	14.8	24.7	2.3	—	11.7	14.0	38.7
Franklin	17.4	.2	3.7	21.3	1.3	—	15.6	16.9	38.2
Fulton	(*)	1.7	1.7	3.4	.3	—	18.4	18.7	22.1
Genesee	—	—	—	—	(*)	—	(*)	(*)	(*)
Green	—	(*)	—	(*)	—	—	—	—	(*)
Hamilton	9.5	1.6	1.8	12.9	1.0	—	36.9	37.9	50.8
Herkimer	4.0	(*)	.2	4.2	(*)	—	6.2	6.2	10.4
Jefferson	.4	—	2.5	2.9	1.1	—	.6	1.7	4.6
Lewis	8.0	—	2.4	10.4	4.1	—	16.6	20.7	31.1
Madison	1.1	—	.7	1.8	(*)	.1	.1	.2	2.0
Montgomery	—	—	.1	.1	(*)	—	—	(*)	.1
Oneida	3.1	—	1.3	4.4	(*)	—	1.4	1.4	5.8
Onondaga	—	—	—	—	—	.1	.1	.2	.2
Orange	—	—	—	—	.1	.3	.4	.8	.8
Oswego	.1	—	—	.1	.2	—	.4	.6	.7
Otsego	1.8	2.4	2.4	6.6	(*)	—	—	(*)	6.6
Rensselaer	.3	.3	1.3	1.9	.5	—	.8	1.3	3.2
St. Lawrence	14.7	2.5	2.5	19.7	5.7	—	15.4	21.1	40.8
Saratoga	.5	4.2	9.8	14.5	1.7	—	25.6	27.3	41.8
Schenectady	(*)	—	.1	.1	—	—	—	—	.1
Schoharie	.3	—	1.4	1.7	.1	.3	.4	.8	2.5
Steuben	—	—	—	—	.3	.5	.6	1.4	1.4
Tioga	—	—	—	—	.3	1.0	1.5	2.8	2.8
Tompkins	—	—	—	—	.3	1.4	1.8	3.5	3.5
Warren	1.4	4.0	12.8	18.2	2.1	—	26.0	28.1	46.3
Washington	(*)	3.2	5.4	8.6	.7	—	11.0	11.7	20.3
Total	77.9	28.1	73.3	179.3	26.6	6.9	239.1	272.6	451.9

[a] Counties with no production are omitted.
* Less than 50 cords.

Table 14.—Pulpwood production from roundwood in Pennsylvania, by county and species group, 1975

[In thousands of rough cords]

County [a]	Softwood				Hardwood				All species
	Spruce and fir	Hemlock and tamarack	Pine	Total	Aspen and yellow-poplar	Oak and hickory	Other hardwoods	Total	
Adams	—	—	0.3	0.3	—	4.8	2.3	7.1	7.4
Allegheny	—	—	—	—	—	.3	.2	.5	.5
Bedford	—	0.5	7.4	7.9	0.5	15.6	23.6	39.7	47.6
Berks	—	—	(*)	(*)	—	.5	.3	.8	.8
Blair	—	—	1.3	1.3	.1	2.6	6.3	9.0	10.3
Bradford	—	—	—	—	5.0	2.9	6.7	14.6	14.6
Bucks	—	—	—	—	—	(*)	—	(*)	(*)
Butler	—	—	—	—	—	—	1.8	1.8	1.8
Cambria	—	.1	(*)	.1	—	.1	.1	.2	.3
Cameron	—	—	—	—	—	19.3	3.1	22.4	22.4
Carbon	—	—	—	—	—	.1	.1	.2	.2
Centre	—	.1	.9	1.0	1.0	11.7	9.0	21.7	22.7
Clarion	—	.1	.1	.2	—	.6	.6	1.2	1.4
Clearfield	—	.7	2.3	3.0	1.5	15.8	12.0	29.3	32.3
Clinton	—	.1	.4	.5	1.6	9.5	11.3	22.4	22.9
Columbia	—	—	—	—	.1	.8	1.0	1.9	1.9
Crawford	—	—	—	—	—	—	1.8	1.8	1.8
Cumberland	—	—	.4	.4	—	1.8	.6	2.4	2.8
Dauphin	—	—	(*)	(*)	.1	.3	.3	.7	.7
Elk	—	—	—	—	—	3.0	13.9	16.9	16.9
Erie	—	—	—	—	—	—	13.6	13.6	13.6
Fayette	—	—	.3	.3	—	.5	1.3	1.8	2.1
Forest	—	—	—	—	—	1.7	7.4	9.1	9.1
Franklin	—	—	.9	.9	—	6.2	3.1	9.3	10.2
Fulton	—	—	2.6	2.6	—	4.5	3.2	7.7	10.3
Greene	—	—	—	—	—	—	(*)	(*)	(*)
Huntingdon	—	.4	2.1	2.5	.3	8.2	4.6	13.1	15.6
Indiana	—	—	1.3	1.3	—	.1	.3	.4	1.7
Jefferson	—	—	.1	.1	—	.6	6.5	7.1	7.2
Juniata	—	—	1.0	1.0	.1	2.3	1.4	3.8	4.8
Lackawanna	—	—	—	—	2.0	2.4	5.2	9.6	9.6
Lancaster	—	—	—	—	(*)	.2	.1	.3	.3
Lebanon	—	—	—	—	—	—	(*)	(*)	(*)
Lehigh	—	—	(*)	(*)	—	—	(*)	(*)	(*)
Luzerne	—	—	—	—	.4	1.8	2.4	4.6	4.6
Lycoming	—	—	(*)	(*)	3.4	13.2	19.2	35.8	35.8
McKean	—	—	—	—	.7	—	16.5	17.2	17.2
Mercer	—	—	(*)	(*)	—	—	1.8	1.8	1.8
Mifflin	—	—	.1	.1	—	.2	.1	.3	.4
Monroe	—	—	—	—	.5	1.3	1.2	3.0	3.0
Northumberland	—	—	(*)	(*)	—	.2	.1	.3	.3
Perry	—	—	.5	.5	.1	2.0	1.2	3.3	3.8
Pike	—	—	—	—	.1	.6	.7	1.4	1.4
Potter	—	—	(*)	(*)	1.6	1.2	15.1	17.9	17.9
Schuylkill	—	—	.1	.1	.2	2.8	2.0	5.0	5.1
Snyder	—	—	.3	.3	—	.2	.1	.3	.6
Somerset	—	—	.4	.4	.1	4.2	5.5	9.8	10.2
Sullivan	—	—	—	—	5.1	4.6	14.0	23.7	23.7
Susquehanna	—	—	—	—	3.0	14.0	19.9	36.9	36.9
Tioga	—	—	—	—	3.5	4.7	7.5	15.7	15.7
Union	—	—	(*)	(*)	—	.6	.3	.9	.9
Venango	—	—	—	—	—	9.4	3.6	13.0	13.0
Warren	—	—	—	—	—	9.9	23.5	33.4	33.4
Wayne	—	—	(*)	(*)	.5	2.4	4.6	7.5	7.5
Westmoreland	—	—	—	—	—	—	(*)	(*)	(*)
Wyoming	—	—	—	—	.3	1.6	2.0	3.9	3.9
York	—	—	4.7	4.7	—	2.2	1.2	3.4	8.1
Total	—	2.0	27.5	29.5	31.8	193.5	284.2	509.5	539.0

[a] Counties with no production are omitted.
* Less than 50 cords.

Table 15.—Pulpwood production from roundwood in Delaware, Maryland, and New Jersey, by state and county and species group, 1975

[In thousands of rough cords]

County[a]	Softwood				Hardwood				All species
	Spruce and fir	Hemlock and tamarack	Pine	Total	Aspen and yellow-poplar	Oak and hickory	Other hardwoods	Total	
				DELAWARE					
Kent	—	—	1.0	1.0	—	—	0.1	0.1	1.1
Sussex	—	—	30.8	30.8	—	3.3	1.7	5.0	35.8
Total	—	—	31.8	31.8	—	3.3	1.8	5.1	36.9
				MARYLAND					
Allegany	—	0.5	4.1	4.6	—	10.3	14.4	24.7	29.3
Anne Arundel	—	—	2.6	2.6	—	—	—	—	2.6
Baltimore	—	—	1.3	1.3	—	1.0	.5	1.5	2.8
Calvert	—	—	5.5	5.5	—	—	—	—	5.5
Caroline	—	—	2.1	2.1	—	(*)	.1	.1	2.2
Carroll	—	—	1.3	1.3	—	.3	.1	.4	1.7
Charles	—	1.5	4.2	5.7	—	(*)	(*)	(*)	5.7
Dorchester	—	—	7.8	7.8	—	.3	.1	.4	8.2
Frederick	—	—	(*)	(*)	—	.3	.1	.4	.4
Garrett	—	.2	1.4	1.6	—	12.0	17.5	29.5	31.1
Harford	—	—	—	—	—	(*)	—	(*)	(*)
Howard	—	—	(*)	(*)	—	(*)	—	(*)	(*)
Kent	—	—	—	—	—	(*)	—	(*)	(*)
Prince Georges	—	—	(*)	(*)	—	—	—	—	(*)
St. Marys	—	—	7.7	7.7	—	.3	—	.3	8.0
Somerset	—	—	11.7	11.7	—	—	—	—	11.7
Talbot	—	—	.1	.1	—	—	—	—	.1
Washington	0.7	—	.6	1.3	—	.9	1.3	2.2	3.5
Wicomico	—	—	20.5	20.5	—	1.1	.4	1.5	22.0
Worcester	—	—	30.2	30.2	—	.1	.1	.2	30.4
Total	0.7	2.2	101.1	104.0	—	26.6	34.6	61.2	165.2
				NEW JERSEY					
Atlantic	—	—	1.6	1.6	—	0.4	—	0.4	2.0
Burlington	—	—	1.0	1.0	—	.2	—	.2	1.2
Camden	—	—	17.9	17.9	—	—	—	—	17.9
Cumberland	—	—	.8	.8	—	.2	—	.2	1.0
Gloucester	—	—	(*)	(*)	—	—	—	—	(*)
Ocean	—	—	.6	.6	—	.2	—	.2	.8
Total	—	—	21.9	21.9	—	1.0	—	1.0	22.9

* Less than 50 cords.

[a] Counties with no production are omitted.

Table 16.—Pulpwood production from roundwood in West Virginia, by county and species group, 1975

[In thousands of rough cords]

County [a]	Softwood				Hardwood				All species
	Spruce and fir	Hemlock and tamarack	Pine	Total	Aspen and yellow-poplar	Oak and hickory	Other hardwoods	Total	
Barbour	—	—	(*)	(*)	—	—	(*)	(*)	(*)
Berkeley	—	0.1	0.7	0.8	—	0.9	1.0	1.9	2.7
Cabell	—	—	.1	.1	—	—	—	—	.1
Calhoun	—	.1	—	.1	—	—	—	—	.1
Doddridge	—	—	.2	.2	—	—	—	—	.2
Fayette	—	—	(*)	(*)	—	.3	(*)	.3	.3
Gilmer	—	—	(*)	(*)	—	.6	.7	1.3	1.3
Grant	—	.5	3.8	4.3	—	60.0	59.4	119.4	123.7
Greenbrier	—	—	1.4	1.4	—	29.6	4.9	34.5	35.9
Hampshire	—	1.0	14.2	15.2	—	6.0	6.9	12.9	28.1
Hardy	—	.5	3.2	3.7	—	2.0	3.1	5.1	8.8
Jackson	—	—	1.6	1.6	—	—	—	—	1.6
Kanawha	—	—	—	—	—	(*)	—	(*)	(*)
Marion	—	—	(*)	(*)	—	—	—	—	(*)
Marshall	—	—	—	—	—	.4	—	.4	.4
Mason	—	—	2.8	2.8	—	—	—	—	2.8
Mineral	—	.5	2.9	3.4	—	6.0	3.7	9.7	13.1
Monroe	—	—	1.7	1.7	—	8.4	1.4	9.8	11.5
Morgan	—	.4	4.7	5.1	—	3.0	2.6	5.6	10.7
Nicholas	—	—	(*)	(*)	—	—	—	—	(*)
Ohio	—	—	(*)	(*)	—	—	—	—	(*)
Pendleton	—	—	.2	.2	—	2.2	1.9	4.1	4.3
Pleasants	—	—	1.0	1.0	—	—	—	—	1.0
Pocahontas	0.3	.1	.8	1.2	—	3.3	2.5	5.8	7.0
Preston	—	—	—	—	—	—	.6	.6	.6
Putnam	—	—	.2	.2	—	—	—	—	.2
Randolph	—	—	.2	.2	—	.5	1.0	1.5	1.7
Summers	—	—	(*)	(*)	—	(*)	(*)	(*)	(*)
Taylor	—	—	—	—	—	—	(*)	(*)	(*)
Tucker	—	—	(*)	(*)	—	.5	.6	1.1	1.1
Upshur	—	—	—	—	—	1.5	.3	1.8	1.8
Wayne	—	—	—	—	(*)	.3	(*)	.3	.3
Wirt	—	—	6.5	6.5	—	—	.1	.1	6.6
Wood	—	—	1.1	1.1	—	5.0	—	5.0	6.1
Total	0.3	3.2	47.3	50.8	(*)	130.5	90.7	221.2	272.0

[a] Counties with no production are omitted.
* Less than 50 cords.

Headquarters of the Northeastern Forest Experiment Station are in Upper Darby, Pa. Field laboratories and research units are maintained at:

- Amherst, Massachusetts, in cooperation with the University of Massachusetts.
- Beltsville, Maryland.
- Berea, Kentucky, in cooperation with Berea College.
- Burlington, Vermont, in cooperation with the University of Vermont.
- Delaware, Ohio.
- Durham, New Hampshire, in cooperation with the University of New Hampshire.
- Hamden, Connecticut, in cooperation with Yale University.
- Kingston, Pennsylvania.
- Morgantown, West Virginia, in cooperation with West Virginia University, Morgantown.
- Orono, Maine, in cooperation with the University of Maine, Orono.
- Parsons, West Virginia.
- Pennington, New Jersey.
- Princeton, West Virginia.
- Syracuse, New York, in cooperation with the State University of New York College of Environmental Sciences and Forestry at Syracuse University, Syracuse.
- Warren, Pennsylvania.

Bones, James T., and David R. Dickson.
1976. **Pulpwood Production in the Northeast—1975.** Northeast. For. Exp. Sta., Upper Darby, Pa.
21 p., illus. (USDA For. Serv. Resour. Bull. NE-45)

An annual report based upon canvasses of plupwood production in the Northeast, containing data about pulpwood production from roundwood in the 14 Northeastern States by counties and species groups, and pulpwood chip production from plant residues. Comparisons are made with the previous year's production data. Trends in pulpwood production for the past 13 years are shown. Also included is a list of the woodpulp mill that were operating in the region in 1975.

861.0(74):721:792

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FOREWORD

UNDER THE AUTHORITY of the McSweeney-McNary Forest Research Act of 22 May, 1928 and subsequent amendments, the Forest Service, U.S. Department of Agriculture, conducts periodic forest surveys of all states to provide up-to-date information about the forest resources of the Nation.

The first forest survey of Vermont was made in 1948 by the Northeastern Forest Experiment Station, with the cooperation of many individuals, forest industries, and state agencies. A second forest survey was completed in 1966.

This third survey was conducted in 1972, again with the cooperation of many individuals and agencies. Special mention is due James Wilkinson, Robert A. Farrington, and Benjamin Hoffman of the Vermont Department of Forests and Parks and their staffs for their continuous assistance and support.

The third inventory of Vermont was directed by Carl E. Mayer, Resources Evaluation unit leader. He was assisted by Joseph E. Barnard, who was responsible for the design of the inventory and sample selection as well as for supervision of data compilation. John R. Peters supervised the photo-interpretation and the data collection by field crews. David R. Dickson applied the generalized data-processing system, FINSYS, to the specific data needs of the Vermont inventory and produced summary tables for the State and by counties and units. Teresa M. Bowers assisted in the inventory design by performing all the calculations necessary for sample-size determination and plot selection. She was responsible for the coordination of key-punching and other data-preparation tasks and the final preparation and statistical checking of tables for the report. James T. Bones, with the assistance of state personnel, collected and compiled the data on timber-products output and industrial utilization of timber. He was assisted in the compilation phase by David R. Dickson and Teresa M. Bowers. Carmela M. Hyland was responsible for administrative and secretarial services.

Field work was completed in December 1972. Final computer output was available in September 1973. Users of this report who have a need for more detailed information or analysis than is presented here should contact the Resources Evaluation unit, Northeastern Forest Experiment Station, 6816 Market Street, Upper Darby, Pennsylvania, 19082. *Users of this report are strongly advised to read carefully the definitions of forest-survey terms and the section on the reliability of the estimates in the appendix of this report.*

The Author

NEAL P. KINGSLEY, research forester, received his bachelor's degree in forestry from the University of New Hampshire in 1961 and his master's degree in forest economics from the same university in 1963. He joined the Northeastern Forest Experiment Station in August 1962 and his resource analyst in the Experiment Station's Resources Evaluation unit at Upper Darby, Pa.

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DICK SMITH PHOTO

COVER PHOTO: A summer view near Craftsbury Common, Vermont.

The FOREST RESOURCES of VERMONT

by Neal P. Kingsley

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DICK SMITH

A winter scene near Barnet, Vermont.

Abstract

A statistical and analytical report of the third forest survey of Vermont by the USDA Forest Service. Statistical findings are based on the remeasurement of 1/5-acre plots and 10-point cluster plots. This report discusses and analyzes trends in forest-land area, timber volume, annual growth, and timber removals. Timber-products output by forest industries, based upon a canvass of industries in 1973, and the importance of timber and forests to the State's economy and environment are also discussed. The report also includes a discussion of the outlook for timber supplies during the next 30 years and forest-management opportunities in the State. Also included are 53 tables of statistical data.

Highlights

★ Commercial forest land area continues to increase. It is now 4,429,900 acres. (See appendix for metric equivalents of units used in this report.)

★ Ninety percent of Vermont's commercial forest land is privately owned.

★ An estimated 77,300 owners hold the privately owned commercial forest land in Vermont. The average ownership is 51.6 acres.

★ Although the area of commercial forest land increased only 3 percent, the volume of growing stock increased 7.5 percent. Sawtimber volume rose 14.5 percent.

★ Sugar maple remains the most abundant species—24 percent of the State's timber volume.

★ Sawtimber quality continues to decline: grade-1 sawlogs account for only 1 percent of the pine sawtimber and only 9 percent of the hardwood sawtimber.

★ Net annual growth of growing stock in Vermont is extremely low—only 2.3 percent of the inventory.

★ Pulpwood production continues to increase steadily, while sawlog production holds constant.

★ The timber supply is expected to increase by 1.3 billion cubic feet during the next 30 years.

★ Increasing timber demand provides a major opportunity to improve the condition of the forest resource.

Introduction

THIS REPORT presents a discussion and analysis of the results of the third forest survey of Vermont, completed in 1973. The first forest survey of Vermont was completed in 1948 and the second in 1966 *(Kingsley and Barnard 1968).* Through the years many definitions, procedures, and methods have changed as a result of improved forest-inventory and data-processing techniques. This means that, to analyze actual trends between forest surveys, the estimates from the previous survey must be put on a comparable basis with the current survey. The 1948 and 1966 estimates are valid for the procedures and definitions used at those occasions. The changes in commercial forest area and growing-stock and sawtimber volume, after adjustment of the 1966 data to current standards, are:

	1966	*1973*	*Change*
Commercial forest land *(thousand acres):*	4,295	4,430	+135
Growing stock volume *(million cubic feet):*			
Softwoods	1,604.0	1,718.0	+114.0
Hardwoods	2,794.5	3,012.2	+217.7
Total	4,398.5	4,730.2	+331.7
Sawtimber volume *(million board feet):*			
Softwoods	3,358.0	3,875.5	+517.5
Hardwoods	5,132.7	5,845.2	+712.5
Total	8,490.7	9,720.7	+1,230.0

Forest Area

Forest land continues to occupy an increasing share of the Vermont landscape. In 1973, 76 percent of the State's land area was in forest. This represents a 4-percent gain since 1966 and a 20-percent gain since the first forest survey of Vermont in 1948. Today none of Vermont's counties except Grand Isle has less than 56 percent of its land area in forest, and only 3 of these counties are less than two-thirds forested. (Grand Isle County has been excluded from this timber inventory because of its small size and relative unimportance as a timber-producing county.)

Commercial forest land totals 4,429,900 acres or 75 percent of the State's land area. In addition, 63,800 acres are classified as noncommercial forest land. Of this land, 20,300 acres are unproductive. That is, they are not capable of growing 20 cubic feet of wood per acre per year. In Vermont most of this land is on ridgetops or in swamps and bogs. Another 17,500 acres of land is in Christmas-tree plantations. The remaining 26,000 acres are productive reserved forest land. This is land that is withdrawn from timber production through ordinance, statute, or administrative order. This land includes such areas as state parks and other public recreation sites.

All but one of the State's counties have increased in commercial forest area since 1966. The lone holdout, Chittenden County, dropped only 900 acres. Essex County, in the extreme northeastern corner of the State, continues to hold the title of most heavily forested; 93 percent of its area is in commercial forest. Franklin County showed the greatest gain in commercial forest acreage —up 6 percent—24,900 acres—since 1966.

Forest-Land Ownership

Only 10 percent—441,600 acres—of Vermont's commercial forest land is in public ownership. Of this, 228,600 acres is in the Green Mountain National Forest. Other federal agencies hold only 3,800 acres. The State of Vermont holds 168,200 acres, mostly in State Forests. County and municipal governments hold 41,000 acres.

The 3,988,300 acres that are privately owned are held by an estimated 77,300 different owners. Of these, 73,900 are individuals, 700 are corporations, and 2,700 are clubs, youth organizations, churches, and similar associations. The average size of commercial forest-land ownerships in Vermont is 51.6 acres. The 33,500 owners who own fewer than 10 acres hold an average of only 1.7 acres, primarily as home sites. This means that those 43,800 owners who hold more than 10 acres hold almost 90 acres on average.

Of the 73,900 individuals who own forest land in Vermont, farmers account for only 10 percent; they own 589,000 acres—20 percent of the acreage owned by individuals. Skilled laborers account for more owners than any other group—21,000—nearly 29 percent of all individual owners. However, they do not hold a large share of the acreage held by individuals. The largest share of acreage owned by individuals is owned by professional people. Though they account for less than 12 percent of the individual owners, they hold 22 percent of the commercial forest land held by individuals.

Of the 700 corporations that own commercial forest land in Vermont, 500 are engaged in real estate development. These corporations own more than 115,000 acres. Forest industries own more than 666,000 acres, yet they account for only about 100 owners. The remaining corporate owners include nonforest industries, nonindustrial businesses, and corporate farms. Together, these owners account for only slightly more than 77,000 acres of commercial forest land.

These estimates of privately owned commercial forest land are based on a canvass of forest-land owners in the State. This canvass was conducted concurrently with the resurvey of Vermont. The results of this study will be published separately.

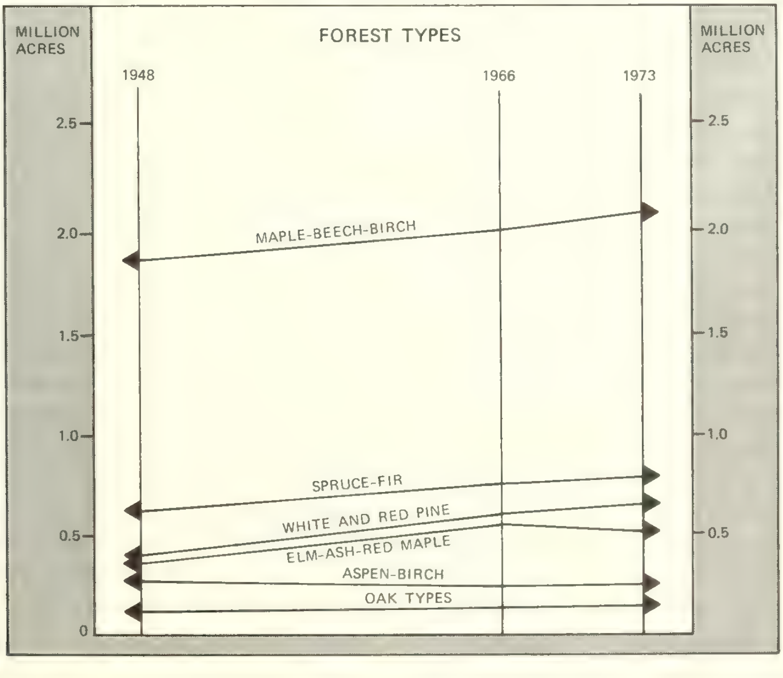
One of the primary objectives of conducting this canvass was to estimate the volume of timber on privately owned commercial forest land that is now or may in the future be available for timber harvesting. Thirty percent of the present owners of commercial forest land in Vermont have at one time or another harvested timber from their lands. These owners account for 66 percent of the privately owned commercial forest land in Vermont. It is interesting to note, in view of this, that only an estimated 7 percent of the owners own their forest land primarily for timber production. These owners, however, own 19 percent of the privately owned commercial forest land in the State.

Forest Types

Although the area of commercial forest land in Vermont increased nearly 135,000 acres during the 7-year period, the proportion of commercial forest land in the various forest types has changed very little (fig. 1). The only proportionate increases were in spruce/fir (up to 18 percent) and the oak/pine type (up to 2 percent)—each a 1-percent gain over 1966.

The only decrease was in the elm/ash/red

Figure 1.—The area of forest types has changed little.



A maple/beech/birch stand with red maple as an important component.

maple type. This type lost nearly 50 thousand acres, dropping from 13 percent of the area in 1966 to 11 percent in 1973. The most logical explanation for the decrease in the area of elm/ash/red maple seems to be linked to changes in species composition as this type matures into sawtimber-size stands.

A characteristic of red maple, the major species in this type, is that, though it has a rapid rate of growth in the poletimber and smaller sizes, it does not sustain this rate of growth as the trees mature. When red maple is associated with the northern hardwood species, the same stand that was typed as elm/ash/red maple when it was poletimber size is often typed as maple/beech/birch as a sawtimber-size stand because the red maple has failed to keep pace with the sugar maple and beech. This conclusion is reinforced by the fact that the maple/beech/birch type, the most prevalent hardwood type in Vermont, increased some 78,000 acres. Undoubtedly much of this increase can be ascribed to this naturally occurring type change in maturing stands.

Stand-Size Classes

In 1966 the forest survey found 41 percent of the stands classified as sawtimber, 35 percent as poletimber, and 24 percent as seedling-sapling stands and nonstocked areas. The 1973 forest survey, however, found that the distribution of stand-size classes has changed. While the area in sawtimber stands rose only from 41 percent in 1966 to 46 percent in 1973, the area in poletimber stands plummeted from 35 percent to 22 percent. The area in seedling-and-sapling stands rose from 24 to 32 percent of the State's commercial forest-land area (fig. 2).

The cause of this apparent turnaround in the trend is linked to timber demand during the period. From 1965 through 1972 the sawlog harvest in Vermont remained essentially constant, and demand for veneer logs declined. However, during this same period the demand for round pulpwood rose 20 percent *(Bones and others 1974)*. This continuing low demand for sawlogs has meant that many white pine and maple/beech/birch

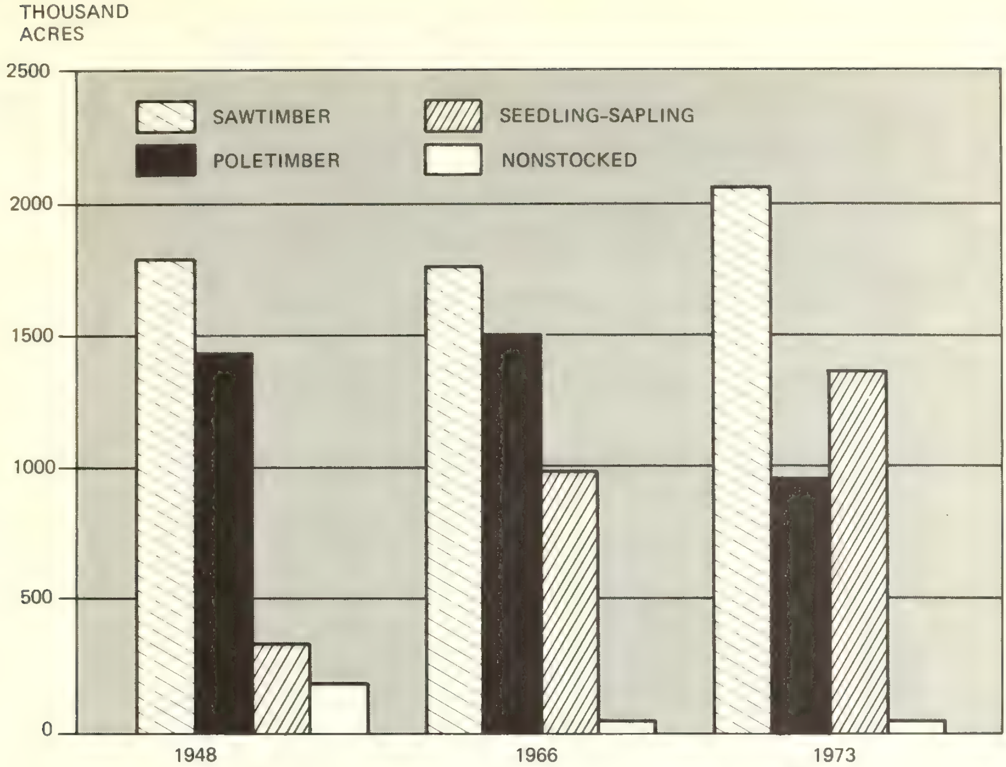


Figure 2.—Changes in stand-size class distribution in three inventories in Vermont.

stands, the major sawtimber-producing types, have been left to grow.

On the other hand, the higher level of demand for pulpwood has apparently meant that stands of spruce/fir and elm/ash/red maple were harvested. These two types produce the bulk of the pulpwood harvest in Vermont. Because individual tree size is not of major concern in pulpwood production, and because of the condition and location of many of the stands in these timber types, it is often most economical as well as silviculturally sound practice to harvest the entire stand either by clearcutting or by a shelterwood system.

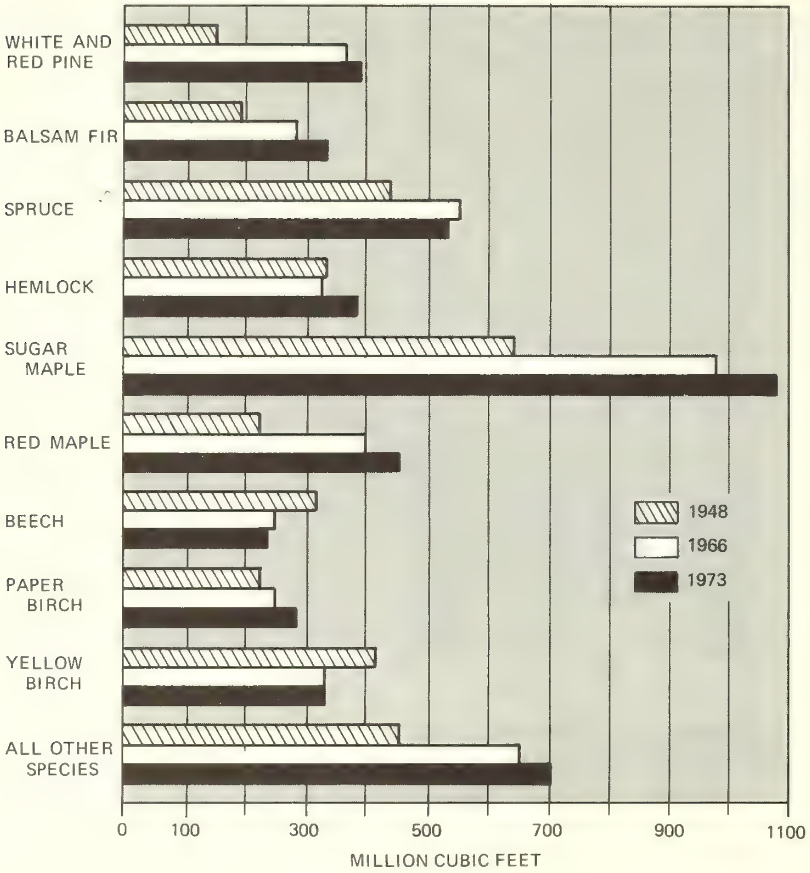
These conclusions are further strengthened by the fact that, in 1973, 67 percent of the white pine type and 55 percent of the maple/beech/birch type was in sawtimber-size stands. On the other hand, 47 percent of the spruce-fir and 39 percent of the elm/ash/red maple was in seedling-sapling stands.

Timber Volume

Although the area of commercial forest land has increased only 3 percent since 1966, the volume of growing stock gained more than 7.5 percent in the same period. In 1973, the volume of growing stock in Vermont stood at 4.7 billion cubic feet, up from 4.4 billion in 1966. Since 1948 the volume of growing stock in the State has risen more than 40 percent. Softwood and hardwood growing stock posted nearly identical gains. Softwood growing stock was up 7.1 percent since 1966 and hardwood up 7.8 percent. However, over the longer period, since 1948, the softwood growing-stock inventory gained more than the hardwood. Softwoods were up over 44 percent while hardwoods gained 38 percent (fig. 3).

The most impressive increase in timber volume was in sawtimber. The volume of sawtimber in Vermont rose from 8.5 billion board feet in 1966 to 9.7 billion in 1973—a

Figure 3.—Changes in growing-stock volume in three inventories in Vermont, by major species.



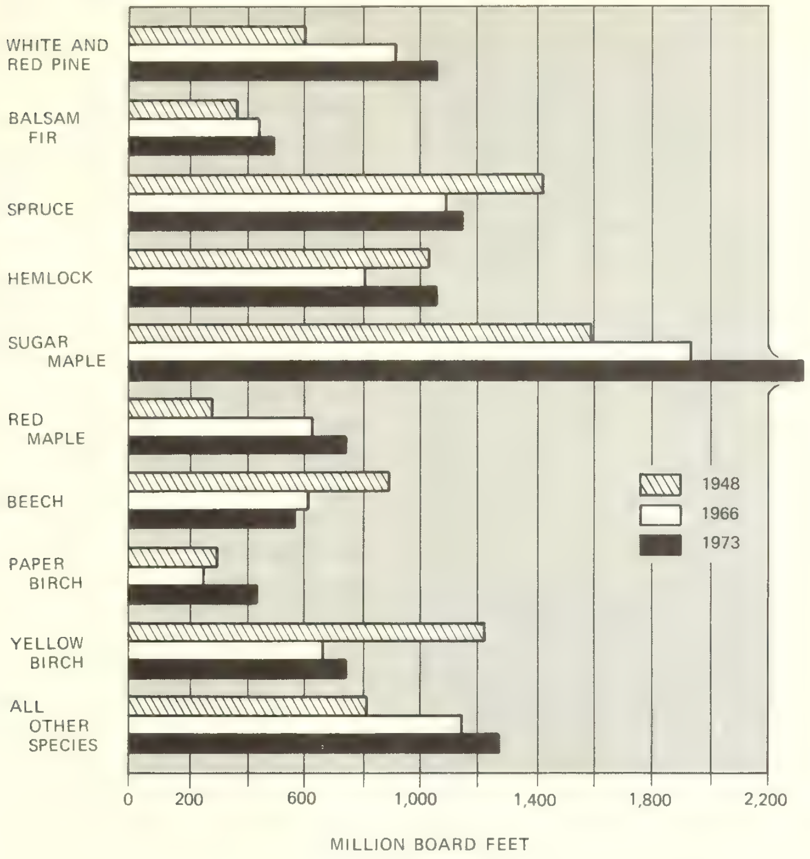
jump of 14.5 percent. Sawtimber gained only 1 percent during the 1948-66 period.

Sugar maple remains the most abundant species in the State, with 1.1 billion cubic feet or 23 percent of the State's total timber volume. Northern red oak showed the greatest increase in volume, rising from 86.2 million cubic feet in 1966 to 113.1 million cubic feet in 1973, a gain of 31 percent in the relatively short period of 7 years. (A similar increase was also observed in New Hampshire.) Low demand for this species seems to be the major factor influencing this increase. Sawtimber-size northern red oak registered a 32-percent increase since 1966. Sawtimber-size sugar maple remains by far the most abundant species in terms of sawtimber volume. In 1973 the volume of sugar maple sawtimber stood at 2.3 billion board feet, up from 1.9 in 1966. No other hardwood species exceeds 1 billion board feet in total volume (fig. 4).

Although it was the only softwood species to show a decline in volume, spruce is still the most abundant softwood. The volume of spruce rose from 440.0 million cubic in 1948 to 549.1 million in 1966. It then declined to 532.3 million in 1973, a drop of 3 percent for the 1966-73 period. After a decline from 1,421.9 million board feet in 1948 to 1,093.6 million in 1966, the spruce sawtimber volume has increased slightly since 1966 and stood at 1,142.0 million board feet in 1973. Of all the softwood species in Vermont, spruce is the most in demand, mostly for pulpwood. These changes reflect this consistent demand.

Several other species showed significant increases in volume from 1966 to 1973. Hemlock showed a gain of 16 percent in growing-stock volume and a 31-percent increase in sawtimber volume. Although white pine showed less than a 5-percent gain in growing-stock volume, the volume of white pine

Figure 4.—Changes in sawtimber volume in three inventories in Vermont, by major species.



sawtimber gained 17 percent. Both of these increases are a reflection of the increased area of sawtimber-size stands in the State and the consistent low level of demand for sawtimber. Paper birch sawtimber rose 31 percent from 1966 to 1973. This also is a reflection of the continuing low demand for sawtimber. Although yellow birch sawtimber registered only an 11-percent gain for the period, this is significant because it reverses the earlier trend.

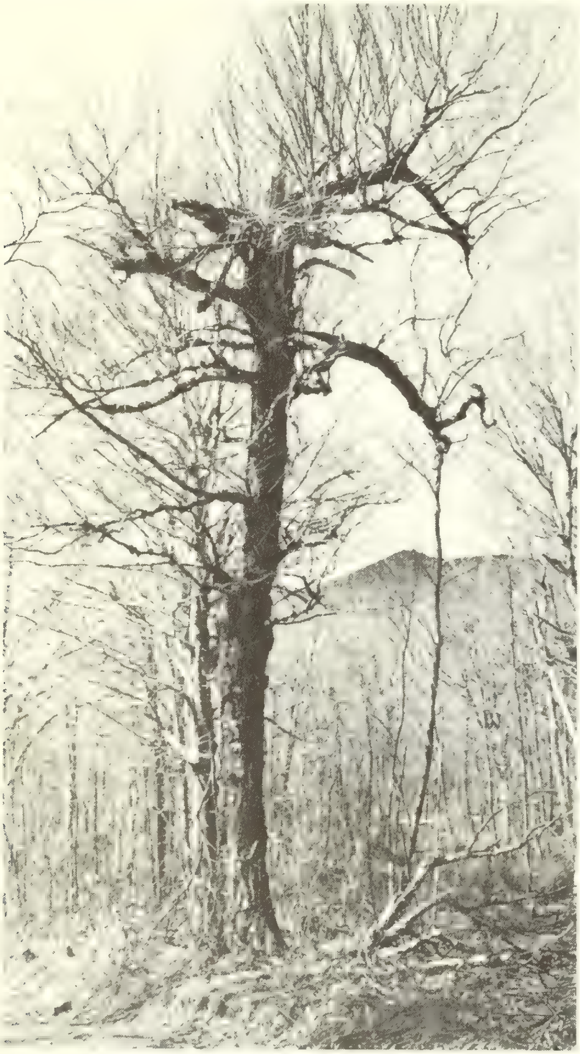
From 1948 to 1966 the yellow birch sawtimber inventory fell from 1,225.4 million board feet to 664.9 million. But by 1973 it was up to 736.5 million board feet. Yellow birch growing stock remained unchanged from the 1966 level.

This fact indicates that little yellow birch regeneration has been occurring in the recent past and that this apparent upsurge in yellow birch sawtimber volume is not likely to be sustained. Yellow birch requires open mineral soils for successful germination of seed and seedling development. Without fire or logging practices that develop such seedbeds, yellow birch may become a relatively minor species in the future.

Sawlog Quality

Despite the fact that the volume of sawtimber in Vermont increased 15 percent since 1966, sawtimber quality continued to decline. In 1966 grade-1 white and red pine sawlogs accounted for 3 percent of the total white and red pine sawlog inventory. By 1973 this percentage had dropped to only 1 percent, despite a 17-percent increase in the total inventory of white and red pine sawlogs. The hardwood story was similar. In 1966, 12 percent of the hardwood sawlog inventory was in grade-1 logs, but by 1973 only 9 percent was grade-1. The hardwood

Rough and rotten trees occupy valuable growing space.



sawlog inventory rose 14 percent during the period.

This decline in sawlog quality was not limited to a few species. In fact, every major species showed a decline in the percentage of the inventory in grade-1 and -2 sawlogs (fig. 5). What caused this decline? There seem to be two major causes: continued high-grading of sawtimber stands and an increased inventory of small-diameter sawtimber trees. When stands are high-graded, only the best stems are harvested, and the poorer stems are left to grow. The net effect is stands that contain poorer and poorer trees. The increase in the inventory of small sawtimber trees, though sometimes another consequence of high-grading, is primarily the result of the increase in the area in sawtimber stands. A grade-1 sawlog must have a minimum diameter inside bark at the small end of 13 inches. It is highly unlikely that a 14-inch dbh tree could contain such a log. Sixty-three percent of Vermont's sawtimber inventory is in trees smaller than 15 inches dbh.

The recent development of tree-length integrated logging systems in the State may help to slow the practice of high-grading. Commonly, in tree-length systems, entire trees are skidded to a landing where the quality material is bucked out and the remainder is utilized for pulpwood or other products for which log quality is not a major consideration.

Growth and Removals

Growth and removals of timber from the inventory can be discussed in several different ways. When it is necessary to understand how the inventory has changed, we discuss the average annual growth and removals. This is the estimated volume of growth or removals for a hypothetical average year during the period between inventories.

In other cases it is necessary to ask: are the growth or removals for the inventory year representative of the average or of the trend during the period between inventories? In this case we compared the average annual growth or removals with the trend (table 20) or actual removals (table 27) for the inventory year. The volume of growth or removals that would be consistent with the average over the period is called trend-level growth or removal. By comparing this estimate, say for removals, with the reported actual volume removed, one can determine whether or not the inventory year was typical of the trend or if it was higher or lower than the trend. This comparison can be very important when predicting or projecting future removals.

The volume of growing stock in Vermont increased 332 million cubic feet, and sawtimber increased 1.2 billion board feet, from 1966 to 1973. In 1965, 42.2 million cubic feet of growing stock were removed; and in 1972, 48.0 million were removed. Annual net growth of growing stock was 2.3 percent of the inventory in both years—88.6 million cubic feet in 1965 and 106.6 million in 1972.

In 1965 sawtimber removals stood at 130 million board feet, and in 1972 they stood at 165 million. However, neither 1965 nor 1972 was a representative year when compared to the trend of sawtimber removals, as evidenced by the estimates as adjusted to the then-existing trends. Removals in 1965 were well below the mid-60s trend while those for 1972 were well above the trend of previous years. Thus, when we adjust these removals to the trend level we see that sawtimber removals have not been increasing, but rather have been on the decline from 248 million board feet in 1965 to 118 in 1972. However, the sawtimber growth rate remained steady at 2.7 percent of the inventory in both years.

During the 1965-72 period, annual net growth of growing stock in Vermont averaged 99.2 million cubic feet. Although this is an increase of 16 million cubic feet per year over the 1947-65 period, growth as a percentage of the inventory remained unchanged at 2.2 percent during the 1965-72 period versus 2.1 percent for the 1947-65 period. Sawtimber growth averaged 301 million board feet per year during the 1965-72 period. This too was essentially unchanged at 3.1 percent of the sawtimber inventory.

Average annual net growth of growing stock in Vermont is extremely low—only 24 cubic feet per acre per year. This fact is vividly illustrated by comparing the com-

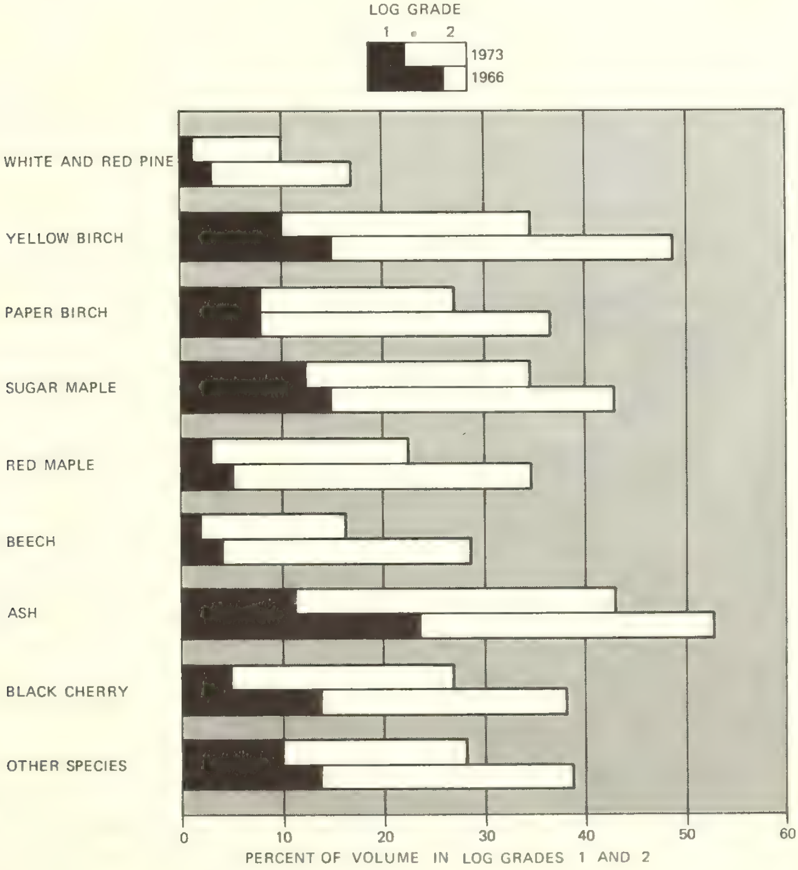


Figure 5.—The decline in sawlog quality is not limited to a few species.

ponents of growth in Vermont with the components in the five other New England states. In these states the average acre of commercial forest land produces an average of 51 cubic feet of wood per year and loses 7 feet to cull increment (the volume in trees of too poor quality to be considered growing stock) and 6 feet to mortality, for an average annual net growth of 38 cubic feet per acre per year. In Vermont, however, the story is much different. The average acre of commercial land in Vermont produces only 41 cubic feet per acre per year, but loses nearly 7 cubic feet to mortality and 10 cubic feet to cull increment for an average annual net growth of only 24 cubic feet.

Why should annual net growth in Vermont be so much lower than that in the rest of New England? The answer to this question lies in the condition of the State's present timber stands rather than in the productive potential of its forest sites. In fact, over 30 percent of Vermont's commercial forest land is considered as capable of producing more than 85 cubic feet of wood per acre per year. In the other 5 states, 38 percent of the area is as productive. One acre in 4 in Vermont is poorly stocked with growing-stock trees. Yet, only 4 percent of all stands are poorly stocked with all trees. This means that valuable growing space is being occupied by inferior trees. Almost 30 percent of all of the live trees in the State over 5 inches dbh are considered rough and/or rotten. By comparison, in the other 5 New England states only 15 percent are rough and/or rotten.

The volume of each of the components of average annual net change in growing stock for the period 1965 through 1972 is shown below:

	Million cubic feet	*Cubic feet per acre*
Accretion (growth on surviving trees)	94.9	21.4
Ingrowth (volume of growth that became pole-sized)	74.5	16.8
Gross growth	169.4	38.2
Cull-tree increment	-42.3	-9.5
Growing-stock mortality	-27.9	-6.3
Net growth	99.2	22.4
Removals	51.8	-11.7
Net change in the inventory	47.4	10.7

Timber-Products Output

The timber-products-output estimates shown in tables 25 through 28 should not be confused with the estimates of annual timber removals shown in tables 20, 21, and 23. In this section of the report actual production data obtained from the Vermont Department of Forests and Parks and similar data gathered as part of this resurvey are used to analyze the 1972 timber harvest and output of timber products. Data presented in tables 20, 21, and 23 are developed from the remeasurement of permanent sample plots. These tables represent the 1972 growth-and-removal situation as indicated by the trend between 1965 and 1972. For this reason slight differences exist between the two sets of data.

Actual production data for a specific year are most useful for analyzing the distribution of timber removals into various categories. Growth-and-removals data based on the trend over the period between inventories are used to analyze the changes in the inventory. In this analysis it is important that the data being analyzed do not represent a typical year.

In 1972, 48.0 million cubic feet of growing stock was removed from Vermont's commercial forest land. Of this volume 32.9 million cubic feet was utilized for timber products. An additional 15.1 million cubic feet was removed as logging residues and other removals. The 32.9 million cubic feet of growing stock that was harvested was below the 35.9 million harvested in 1965. Thus, timber-products output continued to decline in Vermont. The 1972 output of timber products totaled 43.3 million cubic feet. This included both growing-stock material (32.9) and nongrowing-stock material (10.4) such as tops, limbs, and sound material from rough, rotten, or dead trees as well as plant byproducts.

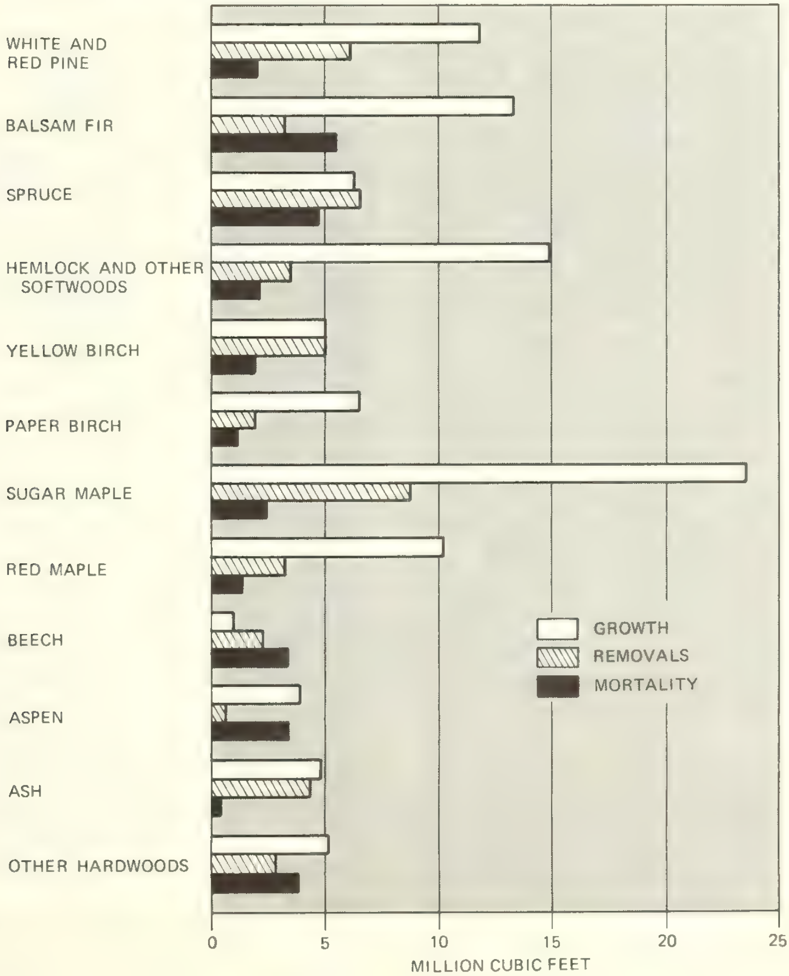
In 1972, Vermont harvested less than half its annual net growth for that year. This was true for both softwoods and hardwoods. However, there were two notable exceptions—spruce and beech. In both of these species, timber removals exceeded growth. For spruce the harvest was only slightly greater than growth; but for beech, removals were more than twice growth.

Most significant in both cases, a reduction in timber mortality could easily have covered the deficit. For spruce a reduction in mortality of only 2 percent would have been nearly sufficient. For beech a reduction of 40 percent would have provided the wood necessary to make removals equal growth. In fact, mortality of beech growing stock was 1.4 times greater than removals and about 3 times growth (fig. 6). It should be noted that the unusually high beech mortality is the result of the beech scale-nectria complex. Nonetheless, a concerted effort should be made to utilize this diseased material rather than to lose it to mortality and subsequent decay. For many major species the annual mortality is high in relation to growth and removals. Such high mortality also reflects the high proportion of rough and rotten trees in Vermont stands.

Sawlog Production

Sawlog production in 1972 totaled 125 million board feet, up 10 million feet from 1965 (fig. 7). Although production rose slightly, the trend to fewer but larger sawmills continued as the number of mills dropped from 191 in 1965 to 170 in 1972. Hardwoods accounted for 56 percent of the 1972 sawlog production. Of the 69.9 million board feet of

Figure 6.—Growth, removals, and mortality of growing stock, by major species, 1972.



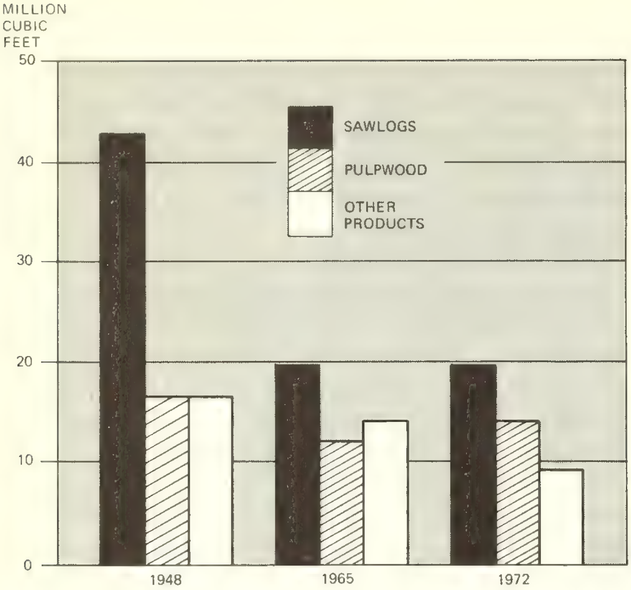


Figure 7.—Production of major timber products in Vermont in 1948, 1965, and 1972.

hardwood sawlogs produced, sugar or hard maple accounted for 33.4 million board feet —48 percent of the hardwood production. Second-place honors went to yellow birch with 11.6 million feet—17 percent of the hardwood output. Of the 55.2 million board feet of softwood sawlogs harvested, white pine accounted for 29.0 million—nearly 53 percent.

Pulpwood Production

Although Vermont has only one small woodpulp mill, pulpwood production continued to increase steadily. In 1972, pulpwood production from all sources totaled 166,604 cords. Of this total, 31,085 cords were produced from plant byproducts, principally chipped sawmill slabs and edgings. The remaining 135,519 cords were produced from roundwood, trees harvested to produce pulpwood, or portions of trees harvested for other products.

Most of the round pulpwood harvested in Vermont is hardwood—about 58 percent. Most of this consists of maple, beech, and birch. Of the 42 percent of round pulpwood production that is softwood, most is spruce and fir—about 82 percent.

Pulpwood production in Vermont rose from only 38,500 cords in 1928 to 197,172 cords in 1948 and then fell to 173,800 cords in 1963. It then began a nearly steady decline to 142,100 cords in 1969. By 1972 production had risen to 166,600 cords, and by 1974, the most recent year for which pulpwood production data are available, production stood at 258,500 cords.

Other Products

Other products in Vermont include veneer logs, poles and posts, turnery bolts, wooden bowls, clapboards, and pre-cut log cabins as well as fuelwood. In 1972, these uses of wood accounted for 9,431,000 cubic feet of the State's output of timber products. This total is down from the 14,156,000 cubic feet produced in 1965 because of the substantial decline in both veneer-log and fuelwood production.

Fuelwood production in 1972 was down substantially from the 1965 output—6,787,000 cubic feet in 1965 compared to 4,335,000 in 1972. The consumption of fuelwood as a home-heating fuel has been declining rapidly since World War II. However, the recent shortages of petrochemical fuels, particularly hard felt in the Northeastern States, may stimulate the use of wood as fuel again.

Production of veneer logs dropped from 15 million board feet in 1965 to only 7 million in 1972. This halving of production accompanied a similar 50-percent drop in the number of veneer plants operating in Vermont from 8 in 1968 to 4 in 1972. Two of the State's plants produce commercial or face veneers for furniture and doors. One of the remaining plants produces container veneers while the other produces specialty veneers. Specialty veneers are used in the manufacture of such products as tongue depressors, popsicle sticks, and toothpicks. Three species—white birch, yellow birch, and beech—traditionally account for the lion's share of Vermont's veneer-log production. In 1972, while more than 10 species of veneer logs were produced, these three species accounted for 71 percent of the production.

Two Vermont forest industries, novelty fencing and pre-cut log cabins, have enjoyed growing markets for their products in recent years. The production of fence posts totaled 429,000 cubic feet, most of which was for novelty fencing. The production of pre-cut cabins consumed about 5 million board feet of white pine, red pine, and spruce in 1972.

Despite the fact that timber-products production has been declining in Vermont in recent years, wood-based industries remain an important segment of the State's economy. According to the 1972 Census of Manufactures, there were 850 manufacturing establishments in the State, of which nearly one-third were wood-using industries. They include not only the primary industries like sawmills and pulpmills, but also the secondary wood-using industries such as furniture manufacturers, millwork manufacturers, and makers of various paper products.

The wood-using industries of Vermont employed 6,800 people and paid a total payroll of $48.2 million. Wood-using establishments in Vermont tend to be smaller than the average of all manufacturing establishments in the State. Thus, while wood-using establishments account for about one-third of all manufacturing they account for only 18 percent of all manufacturing employment. The wood-using industries of Vermont in 1972 had a total value of shipments of $233 million.

Moss Glen Falls—an example of how water adds to Vermont's natural beauty.

Nontimber Benefits of Forests

Many products and benefits of forests never enter the market place, yet they add immeasurably to the quality of life.

Water

The forest lands of Vermont encompass a significant portion of some of the Northeast's most important waterways—the Connecticut and Hudson river systems and the Lake Champlain system. Were the mountains of Vermont not heavily forested, these waterways would be subject to periodic flooding and the waters would not be as attractive because of sedimentation.

In an average year Vermont receives about 40 inches of precipitation, about half in the form of snow. Because the forest acts like a giant sponge to absorb this moisture and prevent excessive runoff, the differences between peak and low flows in the State's waterways is much less than it would otherwise be.

In forested areas stream sedimentation is substantially lower than in regions where other land uses predominate. This is also a result of the absorptive and filtering effect of forest soils. Thus, it is in no small way that forests of Vermont help maintain the State's reputation for clean pleasant streams, lakes, and ponds.

In addition to helping to provide clear streams with a minimum of flooding, forests also help protect public water supplies. Throughout the State there are 177 areas encompassing 42,776 acres of forest land that are managed primarily for watershed protection.

Recreation is a major industry in Vermont. Cross country skiing—renewed interest in an old sport. Snowmobiling—a new interest and continues to gain in popularity. Hiking—always popular with some.

Recreation

Whether it be skiing, camping, hiking, fishing, hunting, or just plain sightseeing, recreation in Vermont is a major industry. Each year millions enjoy Vermont's vibrant autumn foliage, ski the State's many slopes, or camp among its mountains and streams.

During the 1974-75 ski season an estimated 2.8 million skier-days were enjoyed at the State's 70 developed ski areas. The average skier spent approximately $30 per day for lift tickets, lodging, and food. This means that skiers brought nearly $85 million into the Vermont economy.

Snowmobiling is a rapidly growing winter pastime. During the 1974-75 snow season, 34,715 snowmobiles were registered in Vermont. A total of $208,000 in registration fees was collected. From these fees a total $84,000 was spent for the development and maintenance of public snowmobile trails. The remaining $124,000 is used for safety and law enforcement of snowmobilers. As of 1974-75 there were approximately 200 miles of public snowmobile trails on State land. The misuse of snowmobiles has been the source of much controversy and concern for a number of years. In addition to serious accidents involving bodily injury and even death, snowmobiles have at times caused considerable damage by knocking over fences or breaking young trees. To combat this, Vermont, like most other snow states, has turned to registration and regulation of snowmobiles.

In Vermont there are nearly 150 developed campgrounds, having a total of more than 7,500 camping sites. In most recent years about one-half million camper-days were spent at the 43 public campgrounds in Vermont. A camper-day is any day or part of a day spent by an individual camping. If we assume that the rate of occupancy at the more than 100 privately owned campgrounds is slightly better than half the rate at public facilities, we can estimate that nearly 1.5 million camper-days are spent in Vermont annually.

Although it is impossible to estimate how many people participate, hiking and backpacking are enjoyed by thousands in Vermont each year. An estimated 70,000 people hiked at Camel's Hump State Forest.

The forest lands of Vermont host a variety of fish and wildlife species. In addition to providing enjoyment to sightseers, birdwatchers, and other users of the forest, many species provide recreation in the form of hunting and fishing.

During the 1974-75 license year, nearly 134,000 hunting licenses, 90,000 fishing licenses, and more than 55,000 combination hunting and fishing licenses were sold in Vermont. The fact that about 40 percent of the hunting licenses were sold to nonresidents attests to the fact that Vermont is one of the more desirable hunting and fishing states.

During the 1974-75 hunting season, Vermont hunters killed 12,834 deer, 1,580 of these with bow and arrow. This means that one deer was harvested for every 345 acres of commercial forest land. It is interesting to note that at the turn of the century there were believed to be fewer than 500 deer in the entire State. It is generally agreed that the increase in forest area in Vermont has provided an expanded habitat for deer, fostering an explosion of the deer population, despite ever-increasing hunting pressure.

The wild turkey has been reintroduced recently in Vermont.

VERMONT FISH & GAME DEPARTMENT

Also during the 1974-75 season, 227 black bears were taken. And 95 wild turkeys were taken in the spring of 1975 during the State's first spring gobbler season. Turkeys have recently been re-introduced in Vermont with considerable success. In addition to these big-game animals, all denizens of the forest, thousands of ruffed grouse, rabbits, and other small game species were also taken.

Because there is no formal market structure, it is often difficult to determine what effect hunters, fisherman, and other recreationists have on a state's economy. However, two studies have been conducted to estimate the economic impact of hunters and fishermen on Vermont's economy in 1970 *(Gilbert and Khayami 1973; Gilbert 1975)*. These studies show that the State of Vermont received $2,006,479 from hunting and fishing license sales; $1,443,680 of this from nonresidents. Nearly all of these receipts were earmarked for fish and wildlife management programs. However, this is only a small contribution when compared to all expenditures, exclusive of license fees, of hunters and fisherman—a grand total of $65,148,364.

Hunters spent an average of $14 for each of the 2,865,474 hunter-days in the field. These expenditures include ammunition, food, lodging, clothing, and similar variable expenses plus such fixed expenditures as weapons, recreation vehicles, cabins, land, and so forth. Fishermen spent $11.67 for each of the 2,145,029 recreation-days that they pursued their sport. Thus, on average, Vermont hunters and fishermen put $13 into the economy of the State for each day they were afield.

When we apply the 2.5 multiplier used by the Vermont Budget Management Department to the $65 million expenditures and the $2 million in license fees, we find that hunting and fishing have a $167,500,000 effect on the Vermont economy. When one considers that this is an estimate of the economic effect of only hunting and fishing and says nothing of skiing, camping, tourism, and the other forms of outdoor recreation, is it any wonder that one of Vermont's biggest industries is recreation?

Timber-Supply Outlook

All long-range projections are subject to many uncertainties. Long-range projections of timber supply, particularly in the present day, are no exception to this rule. The problem of projecting the supply of timber in Vermont over the next 30 years is complicated by the present economic problems, especially those associated with energy supplies and the current concern for environmental quality. Also, there is the desire of many to spend their leisure hours in a forested setting. In addition, we find that the rate of annual growth of growing stock in Vermont is extremely low, the rate of timber removals even lower than growth, and the forest-based industries in a state of transition.

From 1948 to 1973 the area of commercial forest land in Vermont increased a little more than 700 thousand acres. This increase is expected to continue until about 1980, when the peak of about 4.5 million acres is reached. After 1980 a gradual decline is expected to set in, and by 2003 commercial forest land is expected to total about 4.4 million acres. This slow decline will be the result of further withdrawals for recreational purposes and also as a result of increasing urbanization. It should be noted that many other states in the Northeast have begun to slowly lose commercial forest land after several decades of substantial increases.

Despite the anticipated long-range decrease in commercial forest area, the growing-stock inventory is expected to increase 2.5 billion cubic feet to total 6.0 billion by 2003. Although timber removals from growing stock are expected to increase from 47.8 million cubic feet in 1972 to 127.0 million in 2003, growth of growing stock will also be increasing from 106.6 million cubic feet in 1972 to 154.6 in 2003 (fig. 8). Though this increase may seem substantial in terms of volume, it represents an increase in the rate of growth as a percentage of the inventory of only 0.3 percent. Growing-stock volume per acre is expected to increase from the present 1,068 cubic feet to nearly 1,400 in 2003. Most of this increase will be due to the replacement of nongrowing stock material with growing stock.

Timber-Management Opportunities

The report of the previous forest survey stressed the need for a major timber-stand-improvement effort throughout the State *(Kingsley and Barnard 1968).* This third forest survey of Vermont has found that little progress has been made toward that improvement. Net annual growth is still woefully low at 24 cubic feet per acre per year. Yet 66 percent of the State's commercial forest land is capable of producing 50 cubic feet or more per acre per year.

The major problem remains the inordinate volume of rough and rotten trees. In fact, of the nearly 3 billion trees over 1 inch in diameter that are estimated to be growing on the State's commercial forest land, 49 percent are rough or rotten. Most of Vermont's stands are clogged with poor-quality trees. While only 25 percent of the commercial forest land in the State is fully stocked or overstocked with growing-stock trees, 82 percent is fully stocked or overstocked with both growing-stock and nongrowing-stock trees.

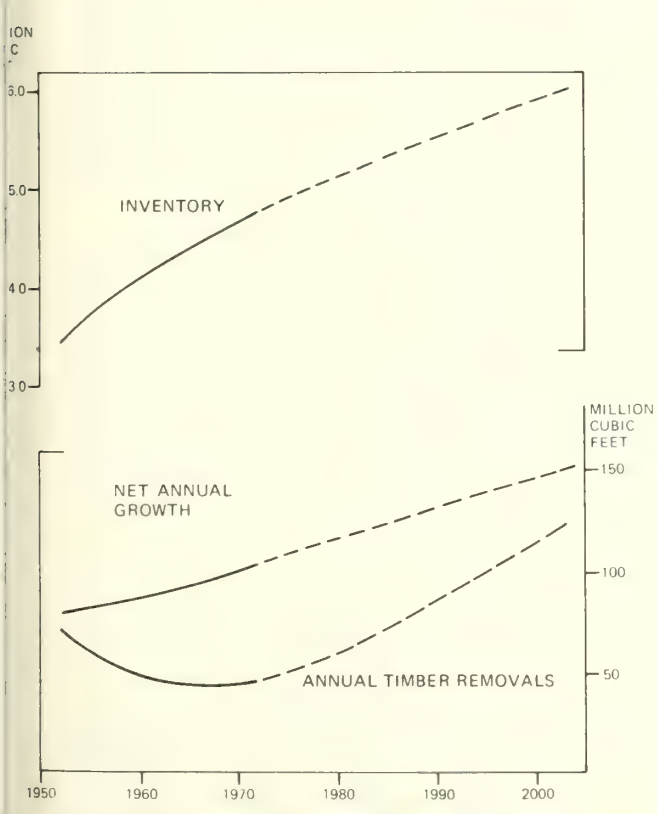


Figure 8.—Projected growing-stock inventory, growth, and removals in Vermont to the year 2003.

The major timber-management objective in Vermont is to reduce the volume of nongrowing stock and to increase the volume of growing stock in the State's forest stands. Only in this way can Vermont realize more of its potential to produce timber. Ironically, it is the increasing demand for timber and the changes that are taking place in the forest-based industries that may provide the best opportunity to accomplish this objective.

Much needed timber-stand-improvement work in Vermont has not been undertaken because it simply was not economically feasible. When cull-tree removal is a direct cost to the landowner, he is likely to forego the expense. When marking timber stands for harvesting, foresters often include as a condition of the sale the removal of poor quality or cull material. However, if the removal of this material represents too great an expense to the logging contractor, or if he is able to find other sales that do not include such conditions, he quite naturally is not interested in such sales. Similarly, while sound forest practice would indicate the need to remove more poor-quality material, the landowner may be reluctant to do so for fear that he will not realize a satisfactory return from the sale of his timber. Thus the theory and practice of forestry collides with the realities of economics.

All this may be changing for the better. Woodpulping technology has been developed to utilize more hardwoods and to even utilize chips with bark to some extent. This opens opportunities to utilize poorer-quality hardwoods. Another possible use for poor-quality material is as fuel. The recent energy shortages may prove to be the sire of this development. It may be feasible to turn turbines to generate electricity with steam produced by burning wood chips. It may also be practical on a large scale to power engines with methanol made from wood. The development of particleboards and reconstituted wood products that can utilize a variety of species may provide added opportunities for the utilization of previously seldom used material.

In the woods, things are also changing. In the past, logging operations were usually undertaken for only one product at a time. In the case of timber harvesting for sawlogs, for instance, this meant that substantial numbers of trees that either did not or never would contain sawlogs were left to grow. Today, however, thanks to modern skidders and loaders, logging contractors often harvest several products at the same time. In this way each tree harvested can be put to its best use.

Another innovation that holds proimse is whole-tree chipping. Frequently poorer-quality trees were not harvested because their crookedness or limbiness made them difficult to handle and transport. With whole-tree chipping, the entire tree is reduced to chips and blown into a van. Costs and problems associated with handling and transportation are substantially reduced.

Whole-tree chipping, as well as multiproduct harvesting, may often provide forest-land owners with the opportunity to harvest previously unmerchantable volume. In this way they may be able to improve the condition of their stands at a profit or at a minimum cost. Previously, needed timber-stand-improvement work went undone because it represented a direct cost to the landowner and he might not reap the benefits of such improvements during his tenure.

In some cases the forest manager may conclude that, in order to realize more of a site's timber-growing potential in the future, the present stand should be liquidated and a new stand started. In these cases it may be necessary to clearcut the stand. When properly applied, silvicultural clearcutting requires that all stems of whatever species over 2 inches in diameter must be removed so that these stems do not dominate the site and inhibit the development of the new stand *(Frank and Bjorkbom 1973)*. Total-tree chipping can be of great help in accomplishing this silvicultural objective too. A frequent criticism of clearcutting is the accumulation of logging slash and debris left on the site. With total-tree chipping, more of the slash goes into product. Also, small trees are not as great a handling problem.

This discussion has centered on forest-management opportunities in which timber production is the objective. However, the production of timber is only one of several forest-management objectives. In a State like Vermont, other objectives such as the maintenance of scenic areas, wildlife-habitat management, and watershed protection are often as important or even more important than the output of timber products. Nonetheless, timber will be produced even when the primary objective is something other than timber. The maintenance of a mixture of species and sizes, and the mixture of open areas in the landscape, not only enhance the esthetic quality of an area, but also provide the varied habitat essential to most wildlife species. The maintenance of healthy vigorous stands in watersheds improves soil stability and porosity, which provide more stable steamflow and minimize siltation.

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Appendix

DEFINITION OF TERMS

Land Area Classes

Land area.—(a) Bureau of the Census. The area of dry land that is temporarily or partly covered by water, such as marshes, swamps, and river flood plains; streams, sloughs, estuaries, and canals that are less than ⅛ statute mile in width; and lakes, reservoirs, and ponds that are less than 40 acres in area. (b) Forest Survey. The same as the Bureau of the Census, except that the minimum width of streams etc. is 120 feet, and the minimum size of lakes etc. is 1 acre.

Forest land.—Land that is at least 16.7 percent stocked (contains at least 7.5 square feet of basal area) by forest trees of any size, or that formerly had such tree cover and is not currently developed for nonforest use. (Forest trees are woody plants that have a well-developed stem and usually are more than 12 feet in height at maturity.) The minimum area for classification of forest land is 1 acre.

Commercial forest land.—Forest land that is producing or capable of producing crops of industrial wood (more than 20 cubic feet per acre per year) and is not withdrawn from timber utilization. (Industrial wood: all roundwood products, except fuelwood.)

Noncommercial forest land.—Forest land that is incapable of yielding timber crops because of adverse site conditions (unproductive forest land), and productive forest land that is withdrawn from commercial timber use (productive-reserved forest land).

Productive-reserved forest land.—Forest land that is sufficiently productive to qualify as commercial forest land, but is withdrawn from timber utilization through statute, administrative designation, or exclusive use for Christmas-tree production.

Unproductive forest land.—Forest land that is incapable of producing 20 cubic feet per acre per year of industrial wood under natural conditions, because of adverse site conditions.

Nonforest land.—Land that has never supported forests, and land formerly forested but now in nonforest use such as for crops, improved pasture, residential areas, and the like.

Ownership Classes

National Forest.—Federal lands that have been legally designated as National Forests or purchase units and other lands that are under the administration of the Forest Service.

Federal.—Lands (other than National Forests) that are administered by federal agencies.

State.—Lands that are owned by the State of Vermont or leased to the State for 50 years or more.

County and municipal.—Lands that are owned by counties and local public agencies or municipalities or leased to them for 50 years or more.

Forest industry.—Lands that are owned by companies or individuals operating wood-using plants.

Farmer-owned.—Lands that are owned by farm operators, whether part of the farmstead or not. Excludes land leased by farm operators from nonfarm owners.

Miscellaneous private.—Privately owned lands other than forest-industry and farmer-owned lands.

Stand-size Classes

Stand.—A growth of trees (see definitions under "Tree Classes") on a minimum of 1 acre of forest land that is at least 16.7 percent stocked by forest trees of any size.

Sawtimber stands.—Stands that are at least 16.7 percent stocked with growing-stock trees, with half or more of total stocking in sawtimber or poletimber trees, and with sawtimber stocking at least equal to poletimber stocking.

Poletimber stands.—Stands that are at least 16.7 percent stocked with growing-stock trees of which half or more of this stocking is in poletimber and/or sawtimber trees and with poletimber stocking exceeding that of sawtimber.

Sapling-seedling stands.—Stands that are at least 16.7 percent stocked with growing-stock trees of which more than half of the stocking is saplings and/or seedlings.

Nonstocked stands.—Commercial forest land that is less than 16.7 percent stocked with growing-stock trees.

Stocking Classes

Stocking.—The degree of occupancy of land by trees, measured in terms of basal area of trees in a stand compared to the basal area of trees required to utilize fully the growth potential of the land. The actual stocking at a point was evaluated against a standard of 75 square feet of basal area per acre (see definition of basal area under "Tree Measurement and Volume"). The stocking percentage for a sample plot is derived from the stocking for each of 10 points. Three categories of stocking are used:

All live trees.—These are used in the classification of forest land and forest types.

Growing-stock trees.—These are used in the classification of stand-size classes.

Desirable trees.—These are used in the classification of area-condition classes.

The degree of plot stocking is viewed as a range of values rather than single points. A fully stocked stand lies within the range of 100 to 130 percent of the basal-area standard. An overstocked stand contains more than 130 percent. The range for medium stocking is 60 to 100 percent and for poor stocking is 16.7 to 60 percent of the basal-area standard. Forest land with less than 16.7 percent of the basal-area standard is classed as nonstocked.

Tree Classes

Forest trees.—Woody plants that have well-developed stems and usually are more than 12 feet in height at maturity.

Commercial species.—Tree species that are presently or prospectively suitable for industrial wood products. Excludes species of typically small size, poor form, or inferior quality, such as hawthorn and sumac.

Growing-stock trees.—Live trees of commercial species that are classified as sawtimber, poletimber, saplings, and seedlings; that is, all live trees of commercial species except rough and rotten trees. (See definitions under "Class of Timber.")

Acceptable trees.—Growing-stock trees of commercial species that meet specified standards of size and quality, but do not qualify as desirable trees.

Desirable trees.—Growing-stock trees of commercial species that (a) have no serious quality defects that limit present or prospective use for timber products, (b) are of relatively high vigor, and (c) contain no pathogens that may result in death or serious deterioration before rotation age.

Rotten trees.—Live trees of commercial species that do not contain at least one 12-foot sawlog or two noncontiguous sawlogs, each 8 feet or longer, now or prospectively, and do not meet regional specifications for freedom from defect primarily because of rot; that is, when more than 50 percent of the cull volume in a tree is rotten.

Rough trees.—(a) The same as above, except that rough trees do not meet regional specifications for freedom from defect primarily because of roughness or poor form, and (b) all live trees that are of noncommercial species.

Site-quality Classes

Site class.—A classification of forest land in terms of inherent capacity to grow crops of industrial wood. Classifications are based upon the mean annual growth of growing stock attainable in fully stocked natural stands at culmination of mean annual growth.

Forest Types

Forest type is a classification of forest land based upon the species forming a plurality of live tree stocking. The many local forest types in Vermont were combined into the following major forest types:

White and red pine.—Forests in which eastern white pine, red pine, or hemlock, singly or in combination, make up a plurality of the stocking. (Common associates include aspen, birch, and maple.)

Spruce/fir.—Forests in which spruce or balsam fir, singly or in combination, make up a plurality of the stocking. Cedar swamps are also in this type. (Common associates include white-cedar, tamarack, maple, birch, and hemlock.)

Oak/pine.—Forests in which hardwoods (usually red or black oaks) comprise a plurality of the stocking but in which pines comprise 25 to 30 percent of the stocking.

Oak/hickory.—Forests in which oaks, singly or in combination, make up a plurality of the stocking, except where pines make up 25 to 30 percent, in which case the stand would be classified oak/pine. Hickory is seldom present in Vermont. (Common associates include elm and the maples.)

Elm/ash/red maple.—Forests in which elm, ash, or red maple, singly or in combination, comprise a plurality of the stocking. (Common associates include beech, white pine, basswood, and sugar maple.)

Maple/beech/birch.—Forests in which maple, beech, or yellow birch, singly or in combination, comprise a plurality of the stocking. (Common associates include hemlock, elm, basswood, white pine, white brich, and red maple.)

Aspen/birch.—Forests in which aspen, balsam poplar, paper birch, or gray birch, singly or in combination, comprise a plurality of the stocking. (Common associates include maple and balsam fir.)

Class of Timber

Softwoods.—Coniferous trees that are usually evergreen, having needles or scalelike leaves.

Hardwoods.—Dicotyledonous trees that are usually broad-leaved and deciduous.

Sawtimber trees.—Live trees of commercial species that (a) are of the following minimum diameters at breast height—softwoods 9.0 inches and hardwoods 11.0 inches, and (b) contain at least one 12-foot merchantable sawlog or two noncontiguous 8-foot merchantable sawlogs and meet regional specifications for freedom from defect.

Poletimber trees.—Live trees of commercial species that meet regional specifications of soundness and form and are at least 5.0 inches dbh but are smaller than sawtimber size.

Saplings.—Live trees of commercial species that are 1.0 to 5.0 inches in diameter at breast height and of good form and vigor.

Seedlings.—Live trees of commercial species that are less than 1.0 inch in diameter at breast height and are expected to survive.

Rough and rotten trees.—See definitions under "Tree Classes".

Timber Measurement and Volume

Basal area.—The area of the cross section at breast height of a single tree, or of all the trees in a stand, usually expressed as square feet per acre.

Board foot.—A unit of lumber measurement 1 foot long, 1 foot wide, and 1 inch thick, or its equivalent. By forest-survey convention, softwoods less than 9.0 inches dbh and hardwoods less than 11.0 inches dbh do not contain board-foot volume.

Diameter at breast height (dbh).—The diameter outside bark of a standing tree measured at 4½ feet above the ground.

Growing-stock volume.—Net volume, in cubic feet, of live growing-stock trees that are 5.0 inches dbh and over, from a 1-foot stump to a minimum 4.0-inch top diameter outside bark of the central stem, or to the point where the central stem breaks into limbs. Net volume equals gross volume less deduction for cull.

International ¼-inch rule.—A log rule or formula for estimating the board-foot volume of logs. Stated mathematically, the formula is $[(D^2 \times 0.22) - 0.71\,D] \times 0.904762$ for 4-foot sections, where D is the diameter inside bark at the small end of the 4-foot section. The International ¼-inch rule is used as the USDA Forest Service standard log rule in the northeastern United States.

Standard cord.—A unit of measure for stacked bolts of wood, encompassing 128 cubic feet of wood, bark, and air space. Cord estimates can be derived from cubic-foot estimates of growing stock by applying an average factor of 80 cubic feet of wood (inside bark) per rough cord.

Sawtimber volume.—Net volume in board feet, International ¼-inch rule, of merchantable sawlogs in live sawtimber trees. Net volume equals gross volume less deductions for rot, sweep, and other defects that affect use for lumber.

Sawlog.—A log that meets minimum standards of diameter, length, and defect, including logs at least 8 feet long, and with a minimum diameter inside bark of 6 inches for softwoods and 8 inches for hardwoods. (See specifications under "Log Grade Classification".)

Sawlog portion.—That part of the bole of a sawtimber tree between the stump and the sawlog top (merchantable height).

Sawlog top.—The point on the bole of a sawtimber tree above which a sawlog cannot be produced. The minimum sawlog top is 7.0 inches d.o.b. for softwoods and 9.0 inches d.o.b. for hardwoods.

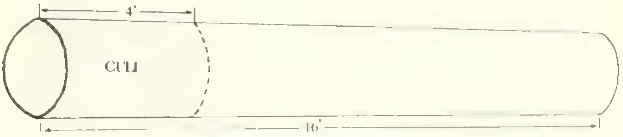
Upper-stem portion.—That part of the main stem or fork of a sawtimber tree above the sawlog top to a diameter of 4.0 inches outside bark or to the point where the main stem or fork breaks into limbs.

Log-Grade Classification

Log grades are a classification of logs based on external characteristics as indicators of quality or value. The log-grade standards and grading systems for softwood and hardwood species used in this forest survey of Vermont are shown in the following specifications.

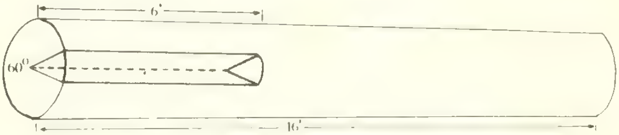
Methods of determining scaling deduction.

(Examples based on a 16-foot log with 20-inch scaling diameter)



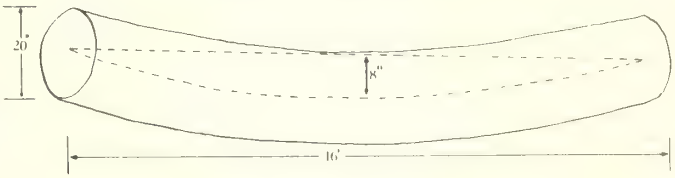
Defect section (rule 1):

Percent deduction $= \frac{4}{16} = 25\%$



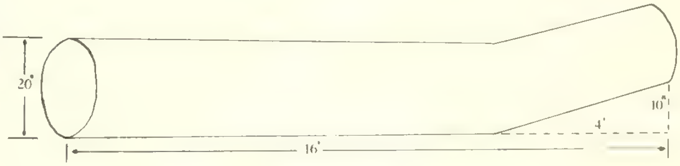
Defect section (rule 2)

Percent deduction $= \left(\frac{6}{16}\right)\left(\frac{60}{360}\right) = 6\ 1/4\%$



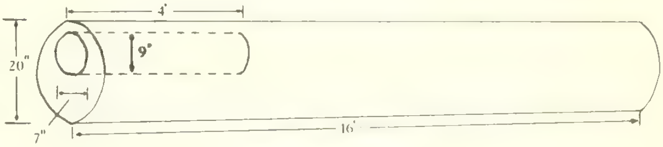
Sweep (rule 3):

Percent deduction $= \frac{8 - 2}{20} = 30\%$



Crook (rule 4)

Percent deduction $= \left(\frac{10}{20}\right)\left(\frac{4}{16}\right) = 12\text{-}1/2\%$



Interior defect (rule 5)

Percent deduction $\frac{(8)\ (10)}{(20 - 1)^2} \times \frac{4}{16} = 5\text{-}5/9\%$

In practice each elipse axis can be divided by (20 — 1) and rounded to nearest tenth if desired.

Thus $\frac{8}{19} = .4,\ \frac{10}{19} = .5$, and $(.4)\ (.5)\left(\frac{4}{16}\right) = 5\%$

From Grosenbaugh, L. R., SHORT CUTS FOR CRUISERS AND SCALERS. USDA Forest Serv. South. Forest Exp. Sta., Occas. Paper 126, 1952.

EASTERN WHITE PINE SAWLOG GRADE SPECIFICATIONS

GRADING FACTOR	LOG GRADE 1	LOG GRADE 2	LOG GRADE 3	LOG GRADE 4
(1) MINIMUM SCALING DIAMETER (inches)	14[1]	6	6	6
(2) MINIMUM LOG LENGTH (feet)	10[2]	8	8	8
(3) MAXIMUM WEEVIL INJURY (number)	None	None	2 injuries[3]	No limit
(4) MINIMUM FACE REQUIREMENTS	Two full length or four 50% length good faces.[4] (In addition, log knots on balance of faces shall not exceed size limitations of grade 2 logs.)	No GOOD FACES REQUIRED Maximum diameter of log knots on three best faces		Includes all logs not qualifying for No. 3 or better and judged to have at least one-third of their gross volume in sound wood suitable for manufacture into standard lumber
		SOUND RED KNOTS not to exceed 1/6 scaling diameter and 3 inch maximum DEAD OR BLACK KNOTS including overgrown knots not to exceed 1/12 scaling diameter and 1½ inch maximum	SOUND RED KNOTS not to exceed 1/3 scaling diameter and 5 inch maximum. DEAD OR BLACK KNOTS including overgrown knots not to exceed 1/6 scaling diameter and 2½ inch maximum	
(5) MAXIMUM SWEEP OR CROOK ALLOWANCE (percent)	20	30	40	66⅔
(6) MAXIMUM TOTAL SCALING DEDUCTION (percent)	50	50	50	66⅔

After the tentative log grade is established from face examination, the log will be reduced in grade whenever the following defects are evident

(7) CONKS, PUNK KNOTS, AND PINE BORER DAMAGE ON BARK SURFACE[5]

Degrade one grade if present on one face
Degrade two grades if present on two faces
Degrade three grades if present on three or more faces

(8) LOG END DEFECTS RED ROT, RING SHAKE, HEAVY STAIN AND PINE BORER DAMAGE OUTSIDE HEART CENTER OF LOG[5]

Consider log as having a total of 8 quarters (4 on each end) and degrade as indicated below.
Degrade one grade if present in 2 quarters of log ends
Degrade two grades if present in 3 or 4 quarters of log ends
Degrade three grades if present in 5 or more quarters of log ends.

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[1] 12 and 13 inch logs with four full length good faces are acceptable
[2] 8 foot logs with four full length good faces are acceptable
[3] 8 foot No 3 logs limited to one weevil injury
[4] Minimum 50% length good face must be at least 6 feet
[5] Factors 7 and 8 are not cumulative (total degrade based on more serious of the two) No log to be degraded below grade 4 if net scale is at least one-third gross log scale

From: Ostrander, M. D., and R. L. Brisbin, SAWLOG GRADES FOR EASTERN WHITE PINE. USDA For. Serv. Res. Pap. NE-205, 1971.

SPRUCE, FIR, HEMLOCK, TAMARACK, AND CEDAR LOG GRADE

(*Minimum merchantability specifications*)

Log grade	*Minimum size*		*Defect allowance*		*Other requirements*
	Diameter[1]	*Length*[2]	*Sweep or crook*	*Total deduction*	
	Inches	*Feet*	*Percent*	*Percent*	
1	10-12	8-16 in 2-foot multiples	25	50	Sound knots not over 2 inches in diameter permitted. Shake permitted up to 20 percent of gross scale if not combined with other serious defects.
	13+	8-16 in 2-foot multiples	25	50	Sound knots not over 3 inches in diameter permitted. Shake permitted up to 20 percent of gross scale if not combined with other serious defects.

[1] At small end of log.
[2] Without trim.

Forest Service standard grades for hardwood factory lumber logs.[a]

Grading Factors		Log grades							
		F1			F2				F3
Position in tree		Butts only	Butts & uppers		Butts & uppers				Butts & uppers
Scaling diameter, inches		13-15[b]	16-19	20+	11+[c]	12+			8+
Length without trim, feet		10+			10+	8-9	10-11	12+	8+
Required clear cuttings[d] of each of 3 best faces[e]	Min. length, feet	7	5	3	3	3	3	3	2
	Max. number	2	2	2	2	2	2	3	No limit
	Min. proportion of log length required in clear cutting	5/6	5/6	5/6	2/3	3/4	2/3	2/3	1/2
Maximum sweep & crook allowance	For logs with less than ¼ of end in sound defects	15%			30%				50%
	For logs with more than ¼ of end in sound defects	10%			20%				35%
Maximum scaling deduction		40%[f]			50%[g]				50%

End defects, although not visible in standing trees, are important in grading cut logs. Instructions for dealing with this factor are contained in Forest Prod. Lab. Rpt. D 1737.

[a] From USDA Forest Service Research Paper FPL-63 (*13*).
[b] Ash and basswood butts can be 12 inches if they otherwise meet requirements for small #1's.
[c] Ten-inch logs of all species can be #2 if they otherwise meet requirements for small #1's.
[d] A clear cutting is a portion of a face, extending the width of the face, that is free of defects.
[e] A face is ¼ of the surface of the log as divided lengthwise.
[f] Otherwise #1 logs with 41-60% deductions can be # 2.
[g] Otherwise #2 logs with 51-60% deductions can be # 3.

Forest Service standard specifications for hardwood construction logs.[a]

Position in tree		Butt & upper
Min. diameter, small end		8 inches +
Min. length, without trim		8 feet
Clear cuttings		No requirements.
Sweep allowance, absolute		¼ diameter small end for each 8 feet of length.
Sound surface defects	Single knots	Any number, if no one knot has an average diameter above the callus in excess of ⅓ of log diameter at point of occurrence.
	Whorled knots	Any number if sum of knot diameters above the callus does not exceed ⅓ of log diameter at point of occurrence.
	Holes	Any number provided none has a diameter over ⅓ of log diameter at point of occurrence, and none extends over 3 inches into included timber.[b]
Unsound surface defects		Same requirements as for sound defects if they extend into included timber.[b] No limit if they do not.
End defects	Sound	No requirements.
	Unsound	None allowed; log must be sound internally, but will admit 1 shake not to exceed ¼ the scaling diameter and a longitudinal split not extending over 5 inches into the contained timber.

[a] These specifications are minimum for the class. If, from a group of logs, factory logs are selected first, thus leaving only non-factory logs from which to select construction logs, then the quality range of the construction logs so selected is limited, and the class may be considered a grade. If selection for construction logs is given first priority, then it may be necessary to subdivide the class into grades.

[b] Included timber is always square, and dimension is judged from small end.

From: Rast, E. D., D. L. Sonderman, and G. L. Gammon, A GUIDE TO HARDWOOD LOG GRADING (REVISED). USDA For. Serv. Gen. Tech. Rep. NE-1, 1973.

Annual Net Growth and Timber Removals

Average annual net growth of growing stock.—The change (resulting from natural causes) in volume of sound wood in sawtimber and poletimber trees during the period between surveys, divided by the length of the period. (Components of annual net growth of growing stock include the increment in net volume of trees present at the beginning of the period and surviving to its end, plus net volume of trees reaching poletimber size during the period, minus the net volume of trees that died during the period, minus the net volume of trees that became rough or rotten trees during the period—cull increment.)

Average annual ingrowth of growing stock.—The net cubic-foot volume of trees now classed as growing stock that were less than 5.0 inches dbh on the initial survey, divided by the length of the period between surveys.

Average annual mortality of growing stock.—The net cubic-foot volume removed from the growing stock because of death from natural causes during the period between surveys, divided by the length of the period between surveys.

Average annual growing-stock removals.—The net cubic-foot volume of growing-stock trees harvested or killed in logging, cultural operations such as timber-stand improvement, land-clearing, or changes in land use during the period between surveys, converted to an annual basis.

Average annual net growth of sawtimber.—The change (resulting from natural cuases) in net board-foot volume of sawtimber during the period between surveys, divided by the length of the period. (Components of annual net growth of sawtimber include the increment in net volume of sawtimber trees present at the beginning of the period and surviving to its end, plus the net volume of trees reaching sawtimber size during the period, minus the net volume of sawtimber trees that died during the period, minus the net volume of sawtimber trees that became rough or rotten trees during the period between surveys—cull increment.)

Average annual ingrowth of sawtimber.—The net board-foot volume of trees now classed as sawtimber that were not tallied as such on the initial survey, divided by the length of the period between surveys.

Average annual mortality of sawtimber.—The net board-foot volume removed from live sawtimber by death from natural causes during the period between surveys, divided by the length of the period between surveys.

Average annual sawtimber removals.—The net board-foot volume of sawtimber trees harvested or killed in logging, cultural operations such as timber-stand improvement, land-clearing, or changes in land use during the period between surveys, converted to an annual basis.

Cull increment.—The net volume of growing-stock trees on the initial inventory that became rough or rotten trees in the second inventory.

Logging residues.—The unused growing-stock volume of trees cut for products and the total growing-stock of trees destroyed in the course of logging but not removed for products.

Other removals.—The growing-stock volume of trees that were removed from the inventory and not used for products in cultural operations (weeding, thinning, etc.), land-clearing, and reclassification of some commercial forest land as noncommercial forest land.

Plant byproducts.—Wood products, such as slabs, edgings, and veneer cores, that are obtained incidental to the production of timber products and are utilized in the manufacture of other timber products. (Bark is not included.)

Plant residues.—Wood material produced incidental to the production of timber products but not utilized.

Roundwood products.—Logs, bolts, or other round sections cut from growing stock or nongrowing stock for industrial or nonindustrial uses.

Timber products.—Roundwood products and plant byproducts from all sources.

Timber removals.—The growing-stock volume of trees removed from the inventory for roundwood products, plus logging residues and other removals.

Annual net growth trend-level.—The estimated growth of growing stock or sawtimber for a specific year that is consistent with the average annual growth during the period between surveys and with the current inventory (1972 for Vermont).

Forest-Survey Methods

The Northeastern Forest Experiment Station Resources Evaluation unit used a modification of the Sampling with Partial Replacement inventory design for this re-inventory of Vermont's timber resources. This inventory was based primarily on the remeasurement of plots measured in the 1966 inventory, some of which were installed in 1948. These plots, a total of 959, are a subsample of the 11,250 photo plots interpreted as part of the 1948 survey or of the 10,250 interpreted as part of the 1966 survey. This included 260 circular 1/5-acre ground plots that were originally installed in the initial forest survey of 1948. There were 70 such plots on the Green Mountain National Forest that were remeasured by National Forest personnel. The remaining 190 plots, distributed throughout the State, were measured by Resource Evaluation personnel.

A total of 699 ten-point prism plots also were measured. The plots, which were installed in 1966 as a subsample of the 10,250 photo plots, consist of a cluster of 10 prism points systematically distributed over 1 acre. At each point trees were selected for measurement by using a prism with a basal-area factor of 37.5. Area-attribute data were also tallied at each of the 10 points.

All the plots were reconciled by the field crew at the plot. By accounting for each tree at both inventory occasions (reconciling) it is possible to develop estimates of ingrowth, accretion, cull increment, mortality, and timber removals. These estimates are needed to adequately assess changes in the inventory.

Geographic Sampling Units

In the third survey of Vermont's timber resources, the State was divided into five geographic sampling units. These are identical to the sampling units used in the second forest survey. These units are:

The Northern Unit, including the counties of:
Caledonia
Essex
Franklin
Grand Isle
Lamoille
Orange
Orleans
Washington

The Southern Unit, including the counties of:
Addison
Bennington
Chittenden
Rutland
Windham
Windsor

State Forest Lands in the Northern Unit
State Forest Lands in the Southern Unit
The Green Mountain National Forest

Each geographic sampling unit was treated as a separate and independent inventory. Thus the final estimates presented here for the State of Vermont are the summation of these five separate inventories.

Other Lands

All forest land other than that in National or State Forests was re-inventoried by Resources Evaluation personnel. The field personnel remeasured all the plots, 1/5-acre and 10-point, that had been measured in 1965. They precisely relocated the plot centers, tallied all sample trees, and reconciled their tally with that for 1965.

Estimates of current volume and area were developed by using the remeasured 10-point plots. Current means for each 1965 photo strata were calculated and expanded by the 1965 photo estimates of area.

Estimates of change, growth, mortality, removals, etc., were developed from all the remeasured plots. Independent estimates of these attributes were first developed for the 1/5-acre sample and the 10-point sample. These were then weighted by the reciprocal of their variance and combined to provide estimates of totals. These totals were prorated into various breakdowns, using the tree data from the remeasured 1/5-acre plots.

State Forest Lands

Vermont Department of Forests and Parks foresters gathered the sample data for forest lands. These crews were trained by Resources Evaluation personnel and used the same procedures as Resources Evaluation personnel.

Most of the remeasured field plots on State Forest lands were 10-point prism plots. However, additions to the area of the State Forest system necessitated the selection of more samples from the 1965 photo base. These 10-point prism plots were located and tallied in the field by standard procedures. The data from the new and remeasured 10-point prism plots were combined by photo class to develop estimates of current area and volume statistics for the State Forest lands.

National Forest

National Forest inventory crews remeasured 70 1/5-acre plots as part of the regular management-plan inventory procedure. In addition to these remeasured plots, this inventory consisted of detailed compartment examination on about 15 percent of the forest area. Data on growth, mortality, and removals were obtained from the remeasured sample. The remeasured plots were also a source of current volume statistics. All area data for the forest were obtained from the detailed compartment examinations.

County Data

Many users of Resources Evaluation data have shown a need for county information. To provide such information, within the framework of the survey design, tables for counties have been developed, based on a survey-unit partitioning technique.

First, the geographic stratum means and variances for the various photo-plot strata were applied to the photo-plot data for each county within the stratum. This yielded an estimate of total volume or total commercial forest-land area for each county. Next, the data from all the new ground plots in each geographic stratum were used to partition the county totals into their various components. For example, if a table of cubic-foot volume by softwoods and hardwoods is to be made for a county, the estimate of total cubic-foot volume for that county is partitioned into softwood and hardwood totals according to the proportion of softwoods and hardwoods for all new Resources Evaluation ground plots within the geographic stratum.

Comparisons Between Inventories

After inventories have been completed for several points in time, it is desirable to evaluate the trends between the several inventories and to make comparisons. A comparison of the 1948, 1965, and the 1973 Resources Evaluation estimates of volume, growth, removals, and mortality was made for Vermont. A computer program, TRAS (Timber Resource Analysis System) was used.

Because of changes in procedures and in definitions, it was necessary to adjust the 1948 and 1965 inventory-volume estimates to what they would have been had the 1973 procedures and definitions been used in the 1948 and 1965 inventories. This process involves several calculations and adjustments of the 1948 and 1965 inventories in order to make them comparable with the 1973 inventory. An important step in this process is to recalculate the 1948 and 1965 inventory volume, using the average net volume per tree developed by the third inventory (1973). To do this, the average net volume per tree (for softwoods and hardwoods) developed from the third survey for each 2-inch diameter class was multiplied by the number of trees in each 2-inch diameter class from the 1948 and 1965 inventories. These calculations resulted in inventory estimates for 1948 and 1965 adjusted to 1973 standards and procedures. These adjusted estimates, not the estimates published in the reports of the earlier surveys, are the basis for comparisons between surveys shown in this report.

Data Processing

Field-tally data consisting of plot and individual-tree information were processed and compiled into various tables using FINSYS—Forest Inventory System—on modern, large-capacity, high-speed computers.

FINSYS is a data-processing system consisting primarily of a series of computer programs that was developed by the Northeastern Forest Experiment Station to process and compile a large volume of forest-inventory data. The system consists of an editing subsystem that edits field-tally data for errors; a table-compiling subsystem that compiles tables from edited field data; and finally, an output subsystem that expands the plot data to geographic-unit or statewide estimates and prints the final tables.

(FINSYS was described in a series of research papers by R. W. Wilson and R. C. Peters in 1967: *The Northeastern Forest Inventory Data Processing System,* USDA Forest Service Research Papers NE-61 and NE-70 to 80.)

Before modern computers came into use, the compiling of forest inventory data was a major bottleneck in forest-inventory work. Using FINSYS, it is possible, as in the case of the resurvey of Vermont, to have preliminary estimates available within 6 months after the last plot is taken. To process and compile data for a state the size of Vermont, from key-punching to the output of tables, requires about 2½ months of elapsed time and about 2½ hours of computer time.

FINSYS has several features that make it unique. One of these is the ability not only to calculate inventory estimates but also to calculate the variance and sampling error for each estimate. This feature provides the user with a measure of the reliability of each statistic and the ability to determine the reliability of a new estimate based upon any data combination he may make.

Another feature of FINSYS is its flexibility. The system is not restricted to the Northeastern forest survey but can be used for any large-scale forest inventory. Also, the system does not produce a standard set of tables. The individual user specifies the tables to be developed according to his particular need. Thus, at any stage in the data-processing phase or even at a later date, a specific table can be developed with minimum effort.

RELIABILITY OF THE ESTIMATES

The forest-area and timber-volume data presented in this report were based upon a carefully designed sample of forest conditions throughout Vermont. However, since neither every acre nor every tree in the State was measured, the data presented in this report are estimates. A measure of the reliability of these estimates is given by a sampling error. An associated sampling error was calculated for each estimate in this report. Many of these appear in the data tables.

Briefly, this is how the sampling error indicates the reliability of an estimate. The estimate of the total growing-stock volume in Vermont—4,730 million cubic feet—has an associated sampling error of 2 percent (95 million cubic feet). This means that the best estimate of the total growing-stock volume in Vermont in 1973 is 4,730 million cubic feet. If there are no errors in procedure, the odds are 2 to 1 that, if we repeated the survey in the same way, the resulting estimate of growing-stock volume would be between 4,635 million and 4,825 million cubic feet (4,730 ± 95). Similarly, the odds are 19 to 1 that it would be within ± 190 million cubic feet and 300 to 1 that it would be within ± 285 million cubic feet.

The computed sampling error is not a complete measure of reliability. There are other sources of error that this term does not include. There could be imperfections in volume tables and equations, and errors in field measurement. Procedural errors were kept to a minimum by careful training of all personnel, frequent inspection of field work, and application of the most reliable survey methods.

Computed sampling errors for the totals shown in the statistical tables for Vermont:

	Sampling error (percent)
Commercial forest area: 4,429.9 thousand acres	2.0
Growing-stock volume: 4,730.2 million cubic feet	2.3
Sawtimber volume: 9,720.7 million board feet	3.2
Annual net growth: 106.6 million cubic feet	8.8
Annual removals: 47.8 million cubic feet	29.4

COMMERCIAL TREE SPECIES OF VERMONT

Occurrence[1]	*Common Name*	*Scientific Name*[2]
	Softwoods	
vc	Balsam fir	*Abies balsamea*
vr	Eastern redcedar (savin)[3]	*Juniperus virginiana*
r	Tamarack (larch, hackmatack)	*Larix laricina*
r	Norway spruce	*Picea abies*
c	White spruce	*P. glauca*
c	Black spruce	*P. mariana*
vc	Red spruce	*P. rubens*
r	Red pine	*Pinus resinosa*
c	Pitch pine	*P. rigida*
c	Eastern white pine	*P. strobus*
vr	Scotch pine[4]	*P. sylvestris*
r	Douglas-fir[4]	*Pseudotsuga menziesii*
c	Northern white-cedar	*Thuja occidentalis*
vc	Eastern hemlock	*Tsuga canadensis*
	Hardwoods	
vc	Red maple	*Acer rubrum*
c	Silver maple	*A. saccharinum*
vc	Sugar maple	*A. saccharum*
vc	Yellow birch	*Betula alleghaniensis*
c	Sweet birch (black)	*B. lenta*
r	River birch (red)	*B. nigra*
c	Paper birch (white)	*B. papyrifera*
r	American hornbeam (blue beech)	*Carpinus caroliniana*
r	Hickory	*Carya spp.*
vc	American beech	*Fagus grandifolia*
c	White ash	*Fraxinus americana*
r	Black ash (brown)	*F. nigra*
r	Green ash (red)	*F. pennsylvanica*
r	Butternut	*Juglans cinerea*
vr	Black walnut	*J. nigra*
vr	Black tupelo (blackgum)	*Nyssa silvatica*
c	Eastern hophornbeam (ironwood)	*Ostrya virginiana*
vr	American sycamore (buttonwood)	*Platanus occidentalis*
r	Balsam poplar (balm-of-Gilead)	*Populus balsamifera*
r	Eastern cottonwood	*P. deltoides*
c	Bigtooth aspen (popple)	*P. grandidentata*
c	Quaking aspen (popple)	*P. tremuloides*
r	Pin cherry	*Prunus pensylvanica*
c	Black cherry	*P. serotina*
r	White oak	*Quercus alba*
r	Chestnut oak	*Q. prinus*
c	Northern red oak	*Q. rubra*
r	Black oak	*Q. velutina*
r	Black willow	*Salix nigra*
r	American basswood	*Tilia americana*
c	American elm (white)	*Ulmus americana*
vr	Slippery elm	*U. rubra*
vr	Rock elm	*U. thomasii*

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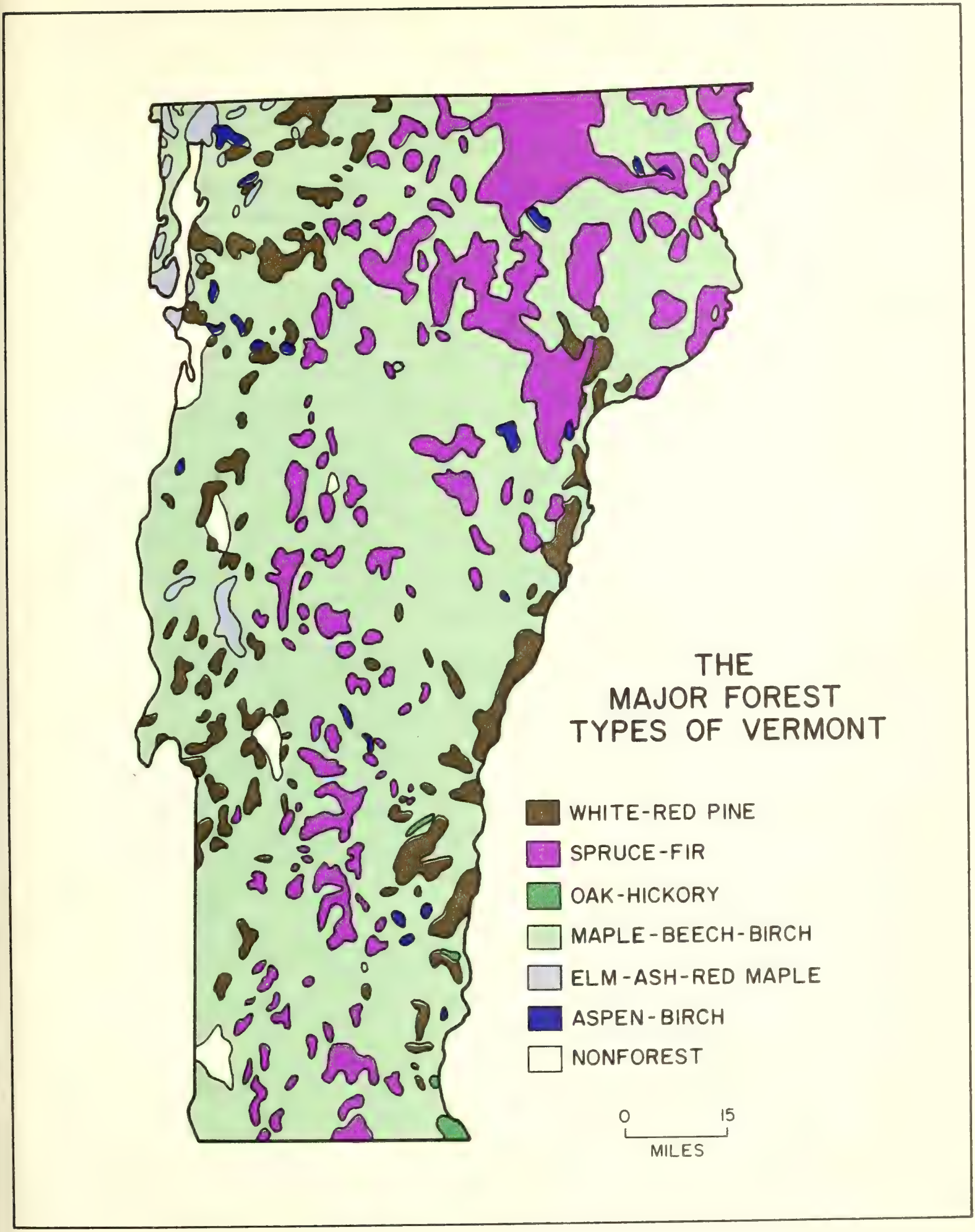
[1] Occurrence is based on the frequency at which the species was encountered on Resources Evaluation field plots: vr—very rare, r—rare, c—common, and vc—very common.

[2] Names according to Little, Elbert L., Jr., Checklist of native and naturalized trees of the United States (including Alaska). U.S. Dep. Agric. Handb. 41, 472 p., illus.

[3] Names in parentheses are other frequently used common names.

[4] Species introduced in Vermont.



THE MAJOR FOREST TYPES OF VERMONT

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Table 1.—Area by land classes, Vermont, 1973

Land class	Area	
	Thousand acres	*Percent*
Forest land:		
Commercial	4,429.9	75
Productive-reserved	26.0	1
Christmas-tree plantation	17.5	(a)
Unproductive	20.3	(a)
Total forest land	4,493.7	76
Nonforest:		
Cropland[b]	792.1	13
Pasture[b]	217.6	4
Other[c]	432.0	7
Total nonforest land	1,441.7	24
Total area[d]	5,935.4	100

[a] Less than 0.5 percent.

[b] Source: 1969 and 1964 Census of Agriculture. Total cropland includes cropland used for pasture. Pasture total based upon ratios developed from the 1964 census report. Data extrapolated to 1973.

[c] Includes swampland industrial and urban areas, other nonforest land, and 37,725 acres classed as water by Resources Evaluation standards but defined by the Bureau of the Census as land.

[d] Source: United States Bureau of the Census, Areas of Vermont: 1960 (January 1967).

Table 2.—Area of commercial forest land, by ownership classes, Vermont, 1973

Ownership class	Area[a]	
	Thousand acres	*Percent*
National Forest	228.6	5
Other federal	3.8	(b)
State	168.2	4
County and municipal	41.0	1
Total public	441.6	10
Forest industry	666.3	15
Farmer owned:		
Corporate	19.3	1
Individual	589.0	13
Other	38.6	1
Total farmer owned	646.9	15
Miscellaneous private:		
Corporate	173.9	4
Individual	2,346.6	53
Other[c]	154.6	3
Total misc. private	2,675.1	60
All ownerships	4,429.9	100

[a] Estimates of area in each private ownership class are based upon the forest-land ownership study by the Northeastern Forest Experiment Station.

[b] Less than 0.5 percent.

[c] Includes acreage owned by business partnerships and organizations such as churches, Boy Scouts of America, and associations.

Table 3.—Area of commercial forest land, by stand-size and ownership classes, Vermont, 1973

[In thousands of acres]

Stand-size class	All ownerships	National Forest	Other public	Forest industry	Farmer and other
Sawtimber stands	2,061.1	127.0	124.6	443.8	1,365.7
Poletimber stands	954.5	63.9	41.1	111.7	737.8
Sapling-seedling stands	1,376.5	37.7	47.3	110.8	1,180.7
Nonstocked areas	37.8	—	—	—	37.8
All classes	4,429.9	228.6	213.0	666.3	3,322.0

Table 4.—Area of commercial forest land, by stand-volume and ownership classes, Vermont, 1973

[In thousands of acres]

Stand-volume per acre (board feet)[a]	All ownerships	National Forest	Other public	Forest industry	Farmer and other
Less than 1,500	1,552.3	119.6	43.9	110.6	1,278.2
1,500 to 5,000	2,094.8	101.3	126.1	442.0	1,425.4
More than 5,000	782.8	7.7	43.0	113.7	618.4
All classes	4,429.9	228.6	213.0	666.3	3,322.0

[a] International ¼-inch rule.

Table 5.—Area of commercial forest land, by stocking classes based on selected stand components, Vermont, 1973

[In thousands of acres]

Stocking class[a] (percent)	Stocking classified in terms of—				
	All trees	Growing-stock trees			Rough and rotten trees
		Total	Desirable	Acceptable	
160	13.2	—	—	—	—
150 to 160	178.9	8.9	—	7.8	—
140 to 150	598.8	21.8	—	13.5	—
130 to 140	705.1	105.6	—	38.1	—
Overstocked	1,496.0	136.3	—	59.4	—
120 to 130	852.0	169.3	—	132.9	8.1
110 to 120	829.0	293.6	—	242.4	9.7
100 to 110	446.5	529.7	—	470.6	2.2
Fully stocked	2,127.5	992.6	—	845.9	20.0
90 to 100	198.3	470.8	—	500.2	29.8
80 to 90	214.9	528.4	—	498.3	56.3
70 to 80	114.7	584.2	—	657.8	219.5
60 to 70	90.4	632.5	—	623.3	281.0
Medium stocked	618.3	2,215.9	—	2,279.6	586.6
50 to 60	63.7	432.1	8.1	471.8	591.2
40 to 50	72.0	365.8	9.6	409.0	559.0
30 to 40	42.3	108.6	41.4	178.4	885.5
20 to 30	10.1	119.1	152.1	118.1	883.1
10 to 20	—	41.2	482.3	49.4	543.0
Less than 10	—	18.3	3,736.4	18.3	361.5
Poorly stocked	188.1	1,085.1	4,429.9	1,245.0	3,823.3
All classes	4,429.9	4,429.9	4,429.9	4,429.9	4,429.9

[a] Fully stocked stands are considered to be 75 to 100 square feet of basal area.

Table 6.—Area of commercial forest land, by area-condition and ownership classes, Vermont, 1973

[In thousands of acres]

Area-condition class[a]	All ownerships	National Forest	Other public	Forest industry	Farmer and other
Class *10-40*	—	—	—	—	—
Class *50*	859.6	29.1	34.4	150.2	645.9
Class *60*	2,274.8	124.5	98.8	289.4	1,762.1
Class *70*	1,295.5	75.0	79.8	226.7	914.0
All classes	4,429.9	228.6	213.0	666.3	3,322.0

[a] Class *10-40*.—Areas medium to fully stocked with desirable trees.
Class *50*.—Areas poorly stocked with desirable trees, but fully stocked with growing-stock trees.
Class *60*.—Areas poorly stocked with desirable trees, but with medium to full stocking of growing-stock trees.
Class *70*.—Areas poorly stocked with desirable trees, and poorly stocked with growing-stock trees.

Table 7.—Area of commercial forest land, by potential site productivity and ownership classes, Vermont, 1973

[In thousands of acres]

Growth-per-acre class (cubic feet)	All ownerships	National Forest	Other public	Forest industry	Farmer and other
120 to 165	474.5	10.1	18.4	53.7	392.3
85 to 120	862.2	26.7	21.1	158.5	655.9
50 to 85	1,603.3	96.0	91.2	191.1	1,225.0
Less than 50	1,489.9	95.8	82.3	263.0	1,048.8
All classes	4,429.9	228.6	213.0	666.3	3,322.0

Table 8.—Area of commercial forest land, by forest types and ownership classes, Vermont, 1973

[In thousands of acres]

Forest type	All ownerships	National Forest	Other public	Forest industry	Farmer and other
White and red pine	650.1	2.4	18.8	25.8	603.1
Spruce/fir	784.4	18.7	25.7	97.6	642.4
Oak/pine	85.3	—	1.7	—	83.6
Oak/hickory	70.9	4.9	1.5	—	64.5
Elm/ash/red maple	504.9	5.2	14.1	9.0	476.6
Maple/beech/birch	2,082.4	188.0	141.9	515.9	1,236.6
Aspen/birch	251.9	9.4	9.3	18.0	215.2
All types	4,429.9	228.6	213.0	666.3	3,322.0

Table 9.—Area of commercial forest land, by forest types and stand-size classes, Vermont, 1973

[In thousands of acres]

Forest type	All stands	Saw-timber stands	Pole-timber stands	Sapling-seedling stands	Nonstocked areas
White and red pine	650.1	437.7	45.2	156.9	10.3
Spruce/fir	784.4	178.3	224.1	372.7	9.3
Oak/pine	85.3	30.9	19.4	35.0	—
Oak/hickory	70.9	42.7	28.2	—	—
Elm/ash/red maple	504.9	180.5	118.2	196.0	10.2
Maple/beech/birch	2,082.4	1,143.7	436.2	502.5	—
Aspen/birch	251.9	47.2	83.2	113.4	8.1
All types	4,429.9	2,061.0	954.5	1,376.5	37.9

Table 10.—Area of commercial forest land by local forest types and major forest types, Vermont, 1973

[In thousands of acres]

Local forest type and major forest type	Forest type
Red pine	20.6
White pine	355.5
White pine/hemlock	63.5
Hemlock	210.5
TOTAL WHITE AND RED PINE	650.1
Balsam fir	299.9
Black spruce	9.2
Red spruce/balsam fir	331.2
Northern white-cedar	105.6
White spruce	38.5
TOTAL SPRUCE/FIR	784.4
White pine/red oak/white oak	85.3
TOTAL OAK/PINE	85.3
White oak/red oak/hickory	17.0
Northern red oak	53.9
TOTAL OAK/HICKORY	70.9
Black ash/elm/red maple	477.4
Willow	27.5
TOTAL ELM/ASH/MAPLE	504.9
Sugar maple/beech/yellow birch	2,037.2
Black cherry	45.2
TOTAL MAPLE/BEECH/BIRCH	2,082.4
Aspen	101.1
Paper birch	150.8
TOTAL ASPEN/BIRCH	251.9
Total all types	4,429.9

Table 11.—Area of forest land, by forest types, Vermont, 1973

[In thousands of acres]

Forest type	All areas	Commercial forest land	Productive-reserved areas	Unproductive areas
White and red pine	652.2	650.1	2.1	—
Spruce/fir	822.0	784.4	20.5	17.1
Oak/pine	85.7	85.3	.4	—
Oak/hickory	71.3	70.9	.4	—
Elm/ash/red maple	508.7	504.9	2.1	1.7
Maple/beech/birch	2,100.3	2,082.4	16.4	1.5
Aspen/birch	253.5	251.9	1.6	—
All types	4,493.7	4,429.9	43.5	20.3

Table 12.—Number of trees on commercial forest land by species groups, tree classes, and diameter classes, Vermont, 1973

[In thousands of trees]

Dbh class (inches)	Softwoods			Hardwoods		
	Growing-stock trees	Rough and rotten trees	Total	Growing-stock trees	Rough and rotten trees	Total
1.0 to 2.9	193,597	205,679	399,276	328,918	641,108	970,026
3.0 to 4.9	160,659	78,096	238,755	220,529	245,084	465,613
Total saplings	354,256	283,775	638,031	549,447	886,192	1,435,639
5.0 to 6.9	97,684	25,004	122,688	124,134	79,903	204,037
7.0 to 8.9	59,537	11,316	70,853	91,184	39,670	130,854
9.0 to 10.9	—	—	—	55,754	19,984	75,738
Total poletimber	157,221	36,320	193,541	271,072	139,557	410,629
9.0 to 10.9	31,987	6,556	38,543	—	—	—
11.0 to 12.9	15,850	2,988	18,838	31,210	12,773	43,983
13.0 to 14.9	7,770	1,438	9,208	16,855	7,939	24,794
Total small sawtimber	55,607	10,982	66,589	48,065	20,712	68,777
15.0 to 16.9	3,406	1,044	4,450	8,104	4,633	12,737
17.0 to 18.9	1,491	597	2,088	4,048	2,923	6,971
19.0 to 20.9	702	246	948	1,758	1,902	3,660
21.0 to 28.9	615	348	963	1,845	3,141	4,986
29.0 and larger	34	43	77	172	638	810
Total large sawtimber	6,248	2,278	8,526	15,927	13,237	29,164
All classes	573,332	333,355	906,687	884,511	1,059,698	1,944,209

Table 13.—Number of growing-stock trees on commercial forest land, by species and diameter classes, Vermont, 1973

[In thousands of trees]

Species	All classes	Diameter class (inches at breast height)									
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.0	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
White and red pine	34,228	11,605	9,251	5,516	3,040	2,091	1,284	757	246	404	34
Balsam fir	56,580	31,359	15,985	6,314	2,027	645	199	51	—	—	—
Spruce	67,435	29,240	19,087	10,470	4,986	2,320	929	201	125	77	—
Hemlock	41,389	13,651	10,841	7,537	4,966	2,553	930	447	331	133	—
Other softwoods [a]	19,444	11,829	4,373	2,150	831	161	64	35	—	1	—
Total softwoods	219,076	97,684	59,537	31,987	15,850	7,770	3,406	1,491	702	615	34
Select red oaks [b]	9,208	2,016	2,370	1,514	1,190	1,049	480	365	134	72	18
Yellow birch	37,817	13,727	8,758	6,427	3,706	2,373	1,516	654	355	266	35
Paper birch	43,081	18,663	12,852	6,744	2,845	1,204	477	177	36	83	—
Sugar maple	102,996	34,851	27,849	18,294	10,605	5,410	2,754	1,574	689	885	85
Red maple	54,121	21,027	14,989	8,949	5,078	2,289	1,016	382	195	184	12
Beech	23,400	7,029	7,213	3,167	2,131	2,123	900	488	222	127	—
Ash	21,076	8,788	5,600	3,206	2,070	847	347	133	18	60	7
Aspen	18,429	8,210	5,639	2,788	946	591	169	54	16	16	—
Black cherry	6,245	2,315	1,498	1,466	531	190	144	57	33	11	—
Other hardwoods	18,691	7,508	4,416	3,199	2,108	779	301	164	60	141	15
Total hardwoods	335,064	124,134	91,184	55,754	31,210	16,855	8,104	4,048	1,758	1,845	172
All species	554,140	221,818	150,721	87,741	47,060	24,625	11,510	5,539	2,460	2,460	206

[a] Includes 18,284,000 northern white-cedar trees.
[b] Includes 570,600 white oak trees.

Table 14.—Net volume of timber on commercial forest land, by class of timber, softwoods and hardwoods, Vermont, 1973

[In millions of cubic feet]

Class of timber	All species	Softwoods	Hardwoods
Sawtimber trees:			
Sawlog portion	1,981.7	852.2	1,129.5
Upper-stem portion	404.3	121.1	283.2
All sawtimber trees	2,386.0	973.3	1,412.7
Poletimber trees	2,344.2	744.7	1,599.5
All growing-stock trees	4,730.2	1,718.0	3,012.2
Rough trees	834.7	284.9	549.8
Rotten trees	340.0	27.6	312.4
Total, all timber	5,904.9	2,030.5	3,874.4

Table 15.—Net volume of growing stock and sawtimber on commercial forest land, by ownership classes, stand-size classes, softwoods and hardwoods, Vermont, 1973

Ownership or stand-size class	Growing stock (Million cubic feet)			Sawtimber (Million board feet)[a]		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
BY OWNERSHIP CLASSES						
National Forest	201.9	40.1	161.8	431.6	65.2	366.4
Other public	235.9	86.2	149.7	524.1	207.7	316.4
Forest industry	707.1	199.6	507.5	1,554.3	450.2	1,104.1
Farmer and other	3,585.3	1,392.1	2,193.2	7,210.7	3,152.4	4,058.3
All ownerships	4,730.2	1,718.0	3,012.2	9,720.7	3,875.5	5,845.2
BY STAND-SIZE CLASSES						
Sawtimber stands	2,813.4	1,015.5	1,797.9	7,151.7	2,788.6	4,363.1
Poletimber stands	1,248.0	424.9	823.1	1,537.3	611.0	926.3
Sapling-seedling stands	664.2	273.0	391.2	1,015.9	460.1	555.8
Nonstocked areas	4.6	4.6	—	15.8	15.8	—
All classes	4,730.2	1,718.0	3,012.2	9,720.7	3,875.5	5,845.2

[a] International ¼-inch rule.

Table 16.—Net volume of growing stock and sawtimber on commercial forest land, by forest type, softwoods and hardwoods, Vermont, 1973

Forest type	Growing stock (Million cubic feet)			Sawtimber (Million board feet)[a]		
	All speices	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
White and red pine	773.1	591.1	182.0	1,863.2	1,561.9	301.3
Spruce/fir	832.4	674.5	157.9	1,436.8	1,234.4	202.4
Oak/pine	81.2	14.1	67.1	156.7	35.3	121.4
Oak/hickory	80.0	10.5	69.5	174.2	16.1	158.1
Elm/ash/red maple	503.8	112.2	391.6	952.7	268.4	684.3
Maple/beech/birch	2,213.5	262.7	1,950.8	4,856.5	667.8	4,188.7
Aspen/birch	246.2	52.9	193.3	280.6	91.6	189.0
All types	4,730.2	1,718.0	3,012.2	9,720.7	3,875.5	5,845.2

[a] International ¼-inch rule.

Table 17.—Net volume of growing stock on commercial forest land, by species and diameter classes, Vermont, 1973

[In millions of cubic feet]

Species	All classes	Diameter class (inches at breast height)									
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
White and red pine	387.1	58.4	67.2	59.8	47.1	45.8	37.8	28.7	11.7	27.1	3.5
Balsam fir	337.7	108.4	102.3	71.3	33.2	15.0	5.8	1.7	—	—	—
Spruce	532.3	117.7	127.4	111.1	78.8	52.1	27.3	7.6	5.7	4.6	—
Hemlock	378.6	49.8	64.8	72.3	71.8	54.0	26.6	16.4	15.1	7.8	—
Other softwoods [a]	82.3	29.2	19.5	16.7	10.8	3.3	1.5	1.3	—	—	—
Total softwoods	1,718.0	363.5	381.2	331.2	241.7	170.2	99.0	55.7	32.5	39.5	3.5
Select red oaks [b]	113.1	7.9	14.6	14.9	18.1	21.8	12.3	12.1	5.6	4.4	1.4
Yellow birch	331.7	48.2	50.7	57.5	49.0	41.8	36.1	19.2	12.8	13.4	3.0
Paper birch	282.1	65.7	73.5	60.5	38.4	22.1	11.5	5.4	1.5	3.5	—
Sugar maple	1,083.2	137.4	189.6	201.4	177.2	127.1	84.7	62.5	33.8	59.3	10.2
Red maple	450.3	74.8	96.1	94.4	77.6	48.6	27.4	12.9	7.9	9.4	1.2
Beech	236.3	24.3	44.1	32.3	32.8	45.0	24.3	17.0	9.4	7.1	—
Ash	181.3	33.2	37.3	35.3	35.4	19.9	10.3	5.0	.9	3.4	.6
Aspen	135.2	28.8	37.1	31.4	15.8	13.7	4.8	2.1	.8	.7	—
Black cherry	46.5	7.1	7.7	13.3	7.3	3.5	3.8	2.0	1.3	.5	—
Other hardwoods	152.5	25.0	25.8	29.6	30.5	15.9	8.0	6.0	2.7	7.3	1.7
Total hardwoods	3,012.2	452.4	576.5	570.6	482.1	359.4	223.2	144.2	76.7	109.0	18.1
All species	4,730.2	815.9	957.7	901.8	723.8	529.6	322.2	199.9	109.2	148.5	21.6

[a] Includes 72,200,000 cubic feet of northern white-cedar.
[b] Includes 4,500,000 cubic feet of white oak.

Table 18.—Net volume of sawtimber on commercial forest land, by species and diameter classes, Vermont, 1973

[In millions of board feet] [a]

Species	All classes	Diameter class (inches at breast height)							
		9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
White and red pine	1,070.4	202.8	184.9	190.2	166.6	127.1	53.1	128.8	16.9
Balsam fir	485.3	253.1	132.9	64.7	26.4	8.2	—	—	—
Spruce	1,142.0	389.0	320.3	223.3	124.0	36.5	27.4	21.5	—
Hemlock	1,050.6	246.1	285.5	224.3	117.0	72.3	70.2	35.2	—
Other softwoods [b]	127.2	58.6	42.1	14.2	6.4	5.6	—	.3	—
Total softwoods	3,875.5	1,149.6	965.7	716.7	440.4	249.7	150.7	185.8	16.9
Select red oaks [c]	315.0	—	66.0	88.9	53.0	54.9	24.9	21.0	6.3
Yellow birch	736.5	—	180.8	170.2	159.3	87.6	58.7	64.8	15.1
Paper birch	333.2	—	142.2	91.9	50.7	24.7	6.7	17.0	—
Sugar maple	2,325.4	—	660.0	518.6	366.3	284.3	154.6	289.9	51.7
Red maple	744.5	—	287.6	194.5	117.2	57.4	36.2	45.6	6.0
Beech	561.4	—	121.3	182.7	104.9	76.2	43.1	33.2	—
Ash	305.6	—	131.2	83.1	44.5	23.2	4.0	16.6	3.0
Aspen	153.7	—	58.5	57.4	21.0	9.3	4.0	3.5	—
Black cherry	74.2	—	26.9	14.0	16.9	8.6	5.5	2.3	—
Other hardwoods	295.7	—	113.1	65.0	34.5	27.6	12.3	34.7	8.5
Total hardwoods	5,845.2	—	1,787.6	1,466.3	968.3	653.8	350.0	528.6	90.6
All species	9,720.7	1,149.6	2,753.3	2,183.0	1,408.7	903.5	500.7	714.4	107.5

[a] International ¼-inch rule.
[b] Includes 95,500,000 board feet of northern white-cedar.
[c] Includes 6,700,000 board feet of white oak.

Table 19.—Net volume of sawtimber on commercial forest land, by species and standard-lumber log grades, Vermont, 1973

[In millions of board feet][a]

Species	All classes	Standard-lumber log grades			
		Grade 1	Grade 2	Grade 3	Grade 4[b]
Softwoods:					
White pine	995.4	11.8	92.2	503.0	388.4
Red pine	75.0	3.0	4.7	51.0	16.3
Other softwoods[c]	2,805.1	—	—	—	—
Total softwoods	3,875.5	14.8	96.9	554.0	404.7
Hardwoods:					
Select red oaks	315.0	54.3	71.1	140.9	48.7
Yellow birch	736.5	71.9	190.2	402.0	72.4
Paper birch	333.2	26.4	64.3	161.3	81.2
Sugar maple	2,325.4	280.4	533.9	1,100.1	411.0
Red maple	744.5	20.2	138.8	396.4	189.1
Beech	561.4	11.2	81.0	334.3	134.9
Ash	305.6	35.0	99.1	111.3	60.2
Aspen	153.7	2.7	16.1	93.4	41.5
Black cherry	74.2	3.6	16.4	34.7	19.5
Other hardwoods	295.7	22.0	48.9	169.6	55.2
Total hardwoods	5,845.2	527.7	1,259.8	2,944.0	1,113.7
			(In percent)		
Hardwood quality	100	9	22	50	19

[a] International ¼-inch rule.
[b] Grade 4 applies only to the pines. For hardwoods the volumes in this column are for construction logs.
[c] Softwood species other than pine are not graded.

Table 20.—Annual net growth, removals, and mortality of growing stock and sawtimber on commercial forest land, by species, Vermont, 1972

Species	Growing stock			Sawtimber		
	Annual net growth	Annual timber removals[a]	Annual mortality	Annual net growth	Annual timber removals[a]	Annual mortality
	Thousand cubic feet			*Thousand board feet*[b]		
Softwoods:						
White and red pine	11,891	6,138	1,874	40,549	16,964	4,073
Balsam fir	13,298	3,311	5,325	15,663	8,641	14,684
Spruce	6,364	6,478	4,644	25,829	17,098	6,040
Hemlock	13,783	3,418	1,318	44,282	9,122	3,814
Other softwoods	1,164	55	639	2,677	175	1,389
Total softwoods	46,500	19,400	13,800	129,000	52,000	30,000
Hardwoods:						
Red oaks	4,442	547	602	10,125	1,884	997
Yellow birch	4,945	4,929	1,669	17,262	11,624	803
Paper birch	6,545	1,747	990	11,451	3,070	—
Sugar maple	23,307	8,680	2,191	58,315	17,101	4,271
Red maple	10,178	3,270	1,152	19,402	6,986	1,908
Beech	976	2,208	3,060	-1,612	6,207	12,006
Ash	4,788	4,397	291	11,397	13,293	—
Aspen	3,849	495	3,282	4,897	1,001	1,334
Black cherry	569	571	181	709	952	—
Other hardwoods	501	1,556	2,882	1,054	3,882	5,681
Total hardwoods	60,100	28,400	16,300	133,000	66,000	27,000
Total, all species	106,600	47,800	30,100	262,000	118,000	57,000

[a] Data for timber removals in this table are based on the trend from 1965 through 1972 and differ from those shown in table 27. Table 27 reports results of a canvass of timber removals for 1972.
[b] International ¼-inch rule.

Table 21.—Annual net growth and removals of growing stock and sawtimber on commercial forest land, by ownership classes, softwoods and hardwoods, Vermont, 1972

Ownership	Annual net growth			Annual timber removals[a]		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
			GROWING STOCK *Thousand cubic feet*			
National Forest	2,623	568	2,055	2,064	402	1,662
Other public	7,847	2,509	5,338	5,714	2,181	3,533
Forest industry	21,942	7,368	14,574	21,233	9,454	11,779
Farmer and other	74,188	36,055	38,133	18,789	7,363	11,426
All ownerships	106,600	46,500	60,100	47,800	19,400	28,400
			SAWTIMBER *Thousand board feet*[b]			
National Forest	8,520	1,358	7,162	12,900	2,326	10,574
Other public	19,083	7,884	11,199	13,411	6,508	6,903
Forest industry	56,449	17,711	38,738	42,657	16,835	25,822
Farmer and other	177,948	102,047	75,901	49,032	26,331	22,701
All ownerships	262,000	129,000	133,000	118,000	52,000	66,000

[a] Data for timber removals in this table are based on the trend from 1965 through 1972 and differ from those shown in table 27. Table 27 reports results of a canvass of timber removals for 1972.

[b] International ¼-inch rule.

Table 22.—Annual mortality of growing stock and sawtimber on commercial forest land, by ownership classes, causes, softwoods and hardwoods, Vermont, 1972

Ownership and cause	Growing stock (thousand cubic feet)			Sawtimber (thousand board feet)[a]		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
			BY OWNERSHIP CLASS			
National Forest	801	186	615	606	129	477
Other public	2,910	2,049	861	4,047	916	3,131
Forest industry	4,812	1,047	3,765	11,113	2,972	8,141
Farmer and other	21,577	10,518	11,059	41,234	25,983	15,251
All ownerships	30,100	13,800	16,300	57,000	30,000	27,000
			BY CAUSE			
Weather	2,544	1,923	621	1,319	1,319	—
Insects	211	211	—	—	—	—
Disease	25,706	10,221	15,485	54,325	27,325	27,000
Other	1,346	1,152	194	—	—	—
Unknown	293	293	—	1,356	1,356	—
All causes	30,100	13,800	16,300	57,000	30,000	27,000

[a] International ¼-inch rule.

Table 23.—Components of annual net growth of growing stock and sawtimber on commercial forest land, softwoods and hardwoods, Vermont, 1972

Components	All species	Softwoods	Hardwoods
		GROWING STOCK *Thousand cubic feet*	
Growth on initial growing-stock inventory[a]	101,553	41,536	60,017
Ingrowth—saplings that became poletimber	80,672	39,482	41,190
Gross growth	182,225	81,018	101,207
Cull increment	45,525	20,718	24,807
Annual mortality	30,100	13,800	16,300
Annual net growth	106,600	46,500	60,100
		SAWTIMBER *Thousand board feet*[b]	
Growth on initial sawtimber inventory[a]	261,048	131,894	129,154
Ingrowth—poletimber trees that became sawtimber	177,771	84,451	93,320
Gross growth	438,819	216,345	222,474
Cull increment	119,819	57,345	62,474
Annual mortality	57,000	30,000	27,000
Annual net growth	262,000	129,000	133,000

[a] Including growth on trees that were cut.

[b] International ¼-inch rule.

Table 24.–Sampling errors for major forest-area and timber-volume classes in Vermont, 1973

Table No.	Item classification	Sampling error	
	FOREST AREA		
		Percent	
1	Forest-land area:		
	Commercial	2.0	
	Unproductive	23.0	
	Total	1.9	
2	Ownership:		
	Forest industry	12	
	Farmer owned	12	
	Misc. private	4	
	Farmer and misc. private	3	
3	Stand-size class:		
	Sawtimber stands	4	
	Poletimber stands	8	
	Sapling-seedling stands	8	
	Nonstocked	49	
4	Stand-volume per acre (board feet):		
	Less than 1,500	7	
	1,500 to 5,000	4	
	More than 5,000	9	
7	Area-condition class:		
	Class *50*	9	
	Class *60*	4	
	Class *70*	8	
8	Growth-per-acre class (cubic feet):		
	120 to 165	12	
	85 to 120	9	
	50 to 85	7	
	Less than 50	7	
9	Forest type:		
	White and red pine	13	
	Spruce/fir	10	
	Oak/pine	36	
	Oak/hickory	32	
	Elm/ash/red maple	13	
	Maple/beech/birch	4	
	Aspen/birch	18	
	TIMBER VOLUME		
		Cubic feet	*Board feet*
		Percent	
14	Class of timber:		
	Sawtimber trees	3	—
	Poletimber trees	3	—
	All growing stock	2	—
	Rough trees	4	—
	Rotten trees	4	—
	All live trees	2	—
15	Ownership:		
	National Forest	3	4
	Other public	13	13
	Forest industry	14	15
	Farmer and other	3	4
15	Stand-size class:		
	Sawtimber stands	5	5
	Poletimber stands	9	10
	Sapling-seedling	8	11
	Nonstocked areas	*	*
		cubic feet	*board feet*
		Percent	
16	Forest type:		
	White and red pine	12	12
	Spruce/fir	11	14
	Oak/pine	39	45
	Oak/hickory	38	48
	Elm/ash/red maple	14	15
	Maple/beech/birch	5	6
	Aspen/birch	21	27
17-18	Diameter classes (inches):		
	5.0- 6.9	4	—
	7.0- 8.9	4	—
	9.0-10.9[a]	4	7
	11.0-12.9	4	4
	13.0-14.9	5	5
	15.0-16.9	5	5
	17.0-18.9	7	7
	19.0-20.9	10	10
	21.0-28.9	10	10
	29.0 and larger	19	19
	Species:		
	White and red pine	13	13
	Balsam fir	10	15
	Spruce	9	12
	Hemlock	11	12
	Other softwoods	25	25
	All softwoods	6	6
	Select red oaks	18	22
	Yellow birch	8	10
	Paper birch	9	14
	Sugar maple	6	8
	Red maple	8	10
	Beech	9	12
	Ash	10	14
	Aspen	17	22
	Black cherry	17	24
	Other hardwoods	11	14
	All hardwoods	3	4
	All species	2.3	3.2
	GROWTH-REMOVAL		
21	Growth by:		
	Softwoods	23	25
	Hardwoods	9	14
	All species	9	13
21	Removals by:		
	Softwoods	48	48
	Hardwoods	27	27
	All species	29	29
	MORTALITY		
22	By species group:		
	Softwoods	29	*
	Hardwoods	19	33
	All species	17	31
22	By cause:		
	Weather	48	*
	Insects	*	—
	Disease	19	33
	Other	39	—
	Unknown	*	*

* Sampling errors of 50 to 99 percent.

[a] Board-foot sampling error for this class is for softwoods only.

Table 25.—Output of timber products, by source of material, softwoods and hardwoods, Vermont, 1972

Product and species group	Standard units	Total output		Output from roundwood		Output from plant byproducts	
		Number of units	Thousand cubic feet	Number of units	Thousand cubic feet	Number of units	Thousand cubic feet
Sawlogs:							
Softwood	M bd. ft. [a]	55,224	8,460	55,224	8,460	—	—
Hardwood	M bd. ft. [a]	69,949	11,269	69,949	11,269	—	—
Total	M bd. ft. [a]	125,173	19,729	125,173	19,729	—	—
Veneer logs and bolts:							
Softwood	M bd. ft. [a]	—	—	—	—	—	—
Hardwood	M bd. ft. [a]	6,977	1,124	6,977	1,124	—	—
Total	M bd. ft. [a]	6,977	1,124	6,977	1,124	—	—
Pulpwood:							
Softwood	Std. cords [b]	62,656	5,325	56,900	4,836	5,756	489
Hardwood	Std. cords [b]	103,948	8,836	78,619	6,683	25,329	2,153
Total	Std. cords [b]	166,604	14,161	135,519	11,519	31,085	2,642[c]
Piling:							
Softwood	M linear ft.	88	54	88	54	—	—
Hardwood	M linear ft.	13	7	13	7	—	—
Total	M linear ft.	101	61	101	61	—	—
Poles:							
Softwood	M pieces	2	6	2	6	—	—
Hardwood	M pieces	—	—	—	—	—	—
Total	M pieces	2	6	2	6	—	—
Post (round and split):							
Softwood	M pieces	388	343	388	343	—	—
Hardwood	M pieces	115	86	115	86	—	—
Total	M pieces	503	429	503	429	—	—
Other:[d]							
Softwood	M cu. ft.	797	797	747	747	50	50
Hardwood	M cu. ft.	2,679	2,679	2,456	2,456	223	223
Total	M cu. ft.	3,476	3,476	3,203	3,203	273	273
Total industrial products:							
Softwood	M cu. ft.	—	14,985	—	14,446	—	539
Hardwood	M cu. ft.	—	24,001	—	21,625	—	2,376
Total	M cu. ft.	—	38,986	—	36,071	—	2,915
Fuelwood:							
Softwood	Std. cords	4,762	381	—	—	4,762	381
Hardwood	Std. cords	49,425	3,954	36,070	2,886	13,350	1,068
Total	Std. cords	54,187	4,335	36,070	2,886	18,112	1,449
All products:[e]							
Softwood	M cu. ft.	—	15,366	—	14,446	—	920
Hardwood	M cu. ft.	—	27,955	—	24,511	—	3,444
Total	M cu. ft.	—	43,321	—	38,957	—	4,364

[a] International ¼-inch rule.

[b] Rough wood basis, includes chips converted to equivalent standard cords.

[c] Pulpwood from plant residues does not agree with table 6 in Resource Bulletin NE-35, Primary Wood-Products Industries of New Hampshire and Vermont, 1972, because of different data sources.

[d] Includes dimension, excelsior, and turnery bolts; and novelty fencing.

[e] Does not include 1,102,884 cubic feet of softwood and 1,969,216 cubic feet of hardwood residues used for agricultural bedding.

Table 26.—Output of roundwood products, by source, softwoods and hardwoods, Vermont, 1972

[In thousands of cubic feet]

Product and species group	All sources	Growing-stock trees[a]			Rough and rotten trees[a]	Salvable dead trees[a]	Other sources[b]
		Total	Sawtimber	Poletimber			
PRINCIPAL INDUSTRIAL PRODUCTS							
Sawlogs:							
Softwood	8,460	7,425	7,334	91	83	66	886
Hardwood	11,269	10,386	10,024	362	143	45	695
Total	19,729	17,811	17,358	453	226	111	1,581
Veneer logs and bolts:							
Softwood							
Hardwood	1,124	1,055	1,019	36	—	—	69
Total	1,124	1,055	1,019	36	—	—	69
Pulpwood:							
Softwood	4,836	4,535	3,355	1,180	—	32	269
Hardwood	6,683	5,069	4,274	795	844	297	473
Total	11,519	9,604	7,629	1,975	844	329	742
MISCELLANEOUS INDUSTRIAL PRODUCTS							
Pilings:							
Softwood	54	48	48	—	—	—	6
Hardwood	7	6	6	—	—	—	1
Total	61	54	54	—	—	—	7
Poles:							
Softwood	6	5	3	2	—	—	1
Hardwood	—	—	—	—	—	—	—
Total	6	5	3	2	—	—	1
Posts: (round and split)							
Softwood	343	316	214	102	14	—	13
Hardwood	86	66	36	30	6	—	14
Total	429	382	250	132	20	—	27
Other:							
Softwood	747	689	466	223	31	—	27
Hardwood	2,456	1,886	1,020	866	182	—	388
Total	3,203	2,575	1,486	1,089	213	—	415
TOTAL INDUSTRIAL PRODUCTS							
Softwood	14,446	13,018	11,420	1,598	128	98	1,202
Hardwood	21,625	18,468	16,379	2,089	1,175	342	1,640
Total	36,071	31,486	27,799	3,687	1,303	440	2,842
NONINDUSTRIAL PRODUCTS							
Fuelwood:							
Softwood	—	—	—	—	—	—	—
Hardwood	2,886	1,388	361	1,027	352	548	598
Total	2,886	1,388	361	1,027	352	548	598
ALL PRODUCTS							
Softwood	14,446	13,018	11,420	1,598	128	98	1,202
Hardwood	24,511	19,856	16,740	3,116	1,527	890	2,238
Total	38,957	32,874	28,160	4,714	1,655	988	3,440

[a] On commercial forest land.

[b] Includes trees less than 5.0 inches in diameter, tree tops and limbs from commercial forest areas, or any material from noncommercial forest land or nonforest land such as fencerows and suburban areas.

Table 27.—Timber removals from growing stock and sawtimber on commercial forest land, by items, softwoods and hardwoods, Vermont, 1972

Item	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	— — Thousand cubic feet — —			*— — Thousand board feet*[a] *— —*		
Roundwood products:						
Sawlogs	17,811	7,425	10,386	87,882	35,689	52,193
Veneer logs and bolts	1,055	—	1,055	4,711	—	4,711
Pulpwood	9,604	4,535	5,069	34,372	15,374	18,998
Piling	54	48	6	265	234	31
Poles	5	5	—	12	12	—
Posts	382	316	66	1,023	858	165
Other	2,575	689	1,886	6,538	1,869	4,669
Fuelwood	1,388	—	1,388	1,243	—	1,243
All products	32,874	13,018	19,856	136,046	54,036	82,010
Logging residues	8,189	2,689	5,500	15,608	4,498	11,110
Other removals	6,895	2,943	3,952	13,142	4,866	8,276
Total removals	47,958	18,650	29,308	164,796	63,400	101,396

[a] International ¼-inch rule.

Table 28.—Volume of unused residues at primary manufacturing plants, by industry and type of residues, and softwoods and hardwoods, Vermont, 1972

[In thousands of cubic feet]

Species groups and type of residues	All industries	Lumber	Veneer and plywood	Other
Softwoods:				
Coarse[a]	323	323	—	—
Fine[b]	83	83	—	—
Total	406	406	—	—
Hardwoods:				
Coarse[a]	221	217	—	4
Fine[b]	144	142	—	2
Total	365	359	—	6
All species:				
Coarse[a]	544	540	—	4
Fine[b]	227	225	—	2
Total	771	765	—	6

[a] Material such as slabs, edgings, and veneer cores.
[b] Material such as sawdust and shavings.

Table 29.—Projections of net annual growth, timber removals, and inventory of growing stock and sawtimber on commercial forest land in Vermont, 1973-2003[a]

Species group	1973 (inventory year)	1983	1993	2003
	GROWING STOCK *Million cubic feet*			
Softwoods:				
Removals	19.4	25	34	44
Growth	46.5	47	52	56
Inventory	1,718.0	2,081	2,371	2,613
Hardwoods:				
Removals	28.4	43	63	83
Growth	60.1	75	87	98
Inventory	3,012.2	3,108	3,302	3,407
Total:				
Removals	47.8	68	97	127
Growth	106.6	122	139	154
Inventory	4,730.2	5,189	5,673	6,020
	SAWTIMBER *Million board feet*			
Softwoods:				
Removals	52.0	68	93	121
Growth	129.0	134	150	162
Inventory	3,875.5	4,627	5,249	5,758
Hardwoods:				
Removals	66.0	100	146	193
Growth	133.0	166	192	217
Inventory	5,845.2	6,032	6,409	6,613
Total:				
Removals	118.0	168	239	314
Growth	262.0	300	342	379
Inventory	9,720.7	10,659	11,658	12,371

[a] Based upon the following assumptions: the area of commercial forest land will begin a slow decrease after 1980; net annual growth as a percent of inventory is expected to increase from 2.3 to 2.6 percent; timber removals will reflect expected timber-product demands and land-use changes.

Table 30.—Area by land classes, geographic units, and counties, Vermont, 1973

Unit and county	Total land area[a]	Nonforest land area	Forest-land area			
			Non-commercial[b]	Commercial		Sampling error[c]
	Thousand acres				*Percent*	
Caledonia	391.9	96.3	4.3	291.3	74	8
Essex	424.5	27.2	1.2	396.1	93	2
Franklin	422.7	184.6	1.2	236.9	56	15
Grand Isle	53.3	53.3	—	—	—	—
Lamoille	303.6	49.2	3.2	251.2	83	5
Orange	441.7	105.3	.5	335.9	76	7
Orleans	457.4	118.3	.1	339.0	74	8
Washington	452.8	86.8	4.7	361.3	80	6
Northern Unit	2,947.9	721.0	15.2	2,211.7	75	3
Addison	501.5	209.2	6.5	285.8	57	16
Bennington	430.2	54.1	5.4	370.7	86	3
Chittenden	341.1	127.9	17.5	195.7	57	14
Rutland	593.3	139.3	9.1	444.9	75	7
Windham	503.6	72.1	3.0	428.5	85	4
Windsor	617.8	118.1	7.1	492.6	80	6
Southern Unit	2,987.5	720.7	48.6	2,218.2	74	3
Total	5,935.4	1,441.7	63.8	4,429.9	75	2

[a] Source: Areas of Vermont: 1960 (January 1967), Bureau of the Census.
[b] Includes nonproductive and productive-reserved forest land.
[c] In percent for commercial forest land at the 68-percent probability level.

Table 31.—Area of commercial forest land, by ownership classes, geographic units, and counties, Vermont, 1973

[In thousands of acres]

Unit and County	Public-owned[a]			Private-owned		Total
	National Forest[b]	State	County and municipal	Farmer-owned	Other private	
Caledonia	—	29.4	2.4	59.3	200.2	291.3
Essex	—	15.2	.9	18.6	361.4	396.1
Franklin	—	1.3	.5	66.2	168.9	236.9
Lamoille	—	7.8	6.0	25.2	212.2	251.2
Orange	0.9	4.8	2.7	59.2	268.3	335.9
Orleans	—	8.9	1.4	77.2	251.5	339.0
Washington	3.3	29.0	5.0	42.0	282.0	361.3
Northern Unit	4.2	96.4	18.9	347.7	1,744.5	2,211.7
Addison	78.1	6.1	2.6	43.2	155.8	285.8
Bennington	64.3	7.5	2.2	20.7	276.0	370.7
Chittenden	—	8.6	2.0	35.6	149.5	195.7
Rutland	48.9	17.5	10.2	69.9	298.4	444.9
Windham	15.8	3.7	2.1	35.1	371.8	428.5
Windsor	21.1	28.4	3.0	56.2	383.9	492.6
Southern Unit	228.2	71.8	22.1	260.7	1,635.4	2,218.2
Total	232.4	168.2	41.0	608.4	3,379.9	4,429.9

[a] From ownership records.
[b] Includes 3,800 acres of other federal ownerships.

Tale 32.—Area of commercial forest land, by stand-size classes, geographic units, and counties, Vermont, 1973

[In thousands of acres]

Unit and county	Sawtimber stands	Poletimber stands	Sapling-seedling stands	Nonstocked areas	Total
Caledonia	113.0	53.5	123.5	1.3	291.3
Essex	199.5	82.8	112.9	.9	396.1
Franklin	62.9	35.5	136.8	1.7	236.9
Lamoille	120.9	51.4	78.0	.9	251.2
Orange	138.9	60.7	134.9	1.4	335.9
Orleans	145.2	62.4	129.8	1.6	339.0
Washington	169.3	71.0	119.6	1.4	361.3
Northern Unit	949.7	417.3	835.5	9.2	2,211.7
Addison	137.6	67.9	77.1	3.2	285.8
Bennington	194.2	97.2	75.3	4.0	370.7
Chittenden	84.1	41.5	66.4	3.7	195.7
Rutland	220.7	106.3	111.3	6.6	444.9
Windham	219.6	108.4	95.3	5.2	428.5
Windsor	255.2	115.9	115.6	5.9	492.6
Southern Unit	1,111.4	537.2	541.0	28.6	2,218.2
Total	2,061.1	954.5	1,376.5	37.8	4,429.9

Table 33.—Area of commercial forest land, by stand-volume classes and geographic units, Vermont, 1973

Stand-volume per acre (board feet)[a]	Northern Unit		Southern Unit		State total	
	Thousand acres	Percent	Thousand acres	Percent	Thousand acres	Percent
Less than 1,500	784.4	36	767.9	35	1,552.3	35
1,500 to 5,000	1,000.6	45	1,094.2	49	2,094.8	47
More than 5,000	426.7	19	356.1	16	782.8	18
All classes	2,211.7	100	2,218.2	100	4,429.9	100

[a] International ¼-inch rule.

Table 34.—Area of commercial forest land, by potential site productivity and geographic units, Vermont, 1973

[In thousands of acres]

Growth-per-acre class (cubic feet)	Northern Unit	Southern Unit	Total
120 to 165	370.1	104.4	474.5
85 to 120	509.4	352.8	862.2
50 to 85	689.2	914.1	1,603.3
Less than 50	643.0	846.9	1,489.9
All classes	2,211.7	2,218.2	4,429.9

Table 35.—Area of commercial forest land, by forest types, geographic units, and counties, Vermont, 1973

[In thousands of acres]

Unit and county	Forest type							Total
	White and red pine	Spruce/ fir	Oak/ pine	Oak/ hickory	Elm/ash/ red maple	Maple/ beech/ birch	Aspen/ birch	
Caledonia	36.9	87.6	1.0	—	30.3	120.8	14.7	291.3
Essex	46.5	100.8	2.1	—	28.7	198.7	19.3	396.1
Franklin	33.2	79.5	.5	—	37.9	75.8	10.0	236.9
Lamoille	29.3	66.2	1.3	—	21.1	121.4	11.9	251.2
Orange	43.1	97.1	1.5	—	34.3	145.4	14.5	335.9
Orleans	42.3	99.7	1.5	—	32.7	147.5	15.3	339.0
Washington	41.0	96.1	2.1	—	30.1	175.7	16.3	361.3
Northern Unit	272.3	627.0	10.0	—	215.1	985.3	102.0	2,211.7
Addison	49.9	19.6	7.7	—	30.5	100.5	17.6	285.8
Bennington	52.2	25.9	9.1	7.1	46.5	206.5	23.4	370.7
Chittenden	42.6	13.8	9.8	—	27.5	85.7	16.3	195.7
Rutland	73.6	30.9	16.1	3.6	57.7	231.8	31.2	444.9
Windham	73.0	30.1	14.3	35.4	60.1	186.7	28.9	428.5
Windsor	86.5	37.1	18.3	24.8	67.5	225.9	32.5	492.6
Southern Unit	377.8	157.4	75.3	70.9	289.8	1,097.1	149.9	2,218.2
Total	650.1	784.4	85.3	70.9	504.9	2,082.4	251.9	4,429.9

Table 36.—Net volume of timber on commercial forest land, by class of timber and geographic units, Vermont, 1973

[In millions of cubic feet]

Class of timber	Northern Unit	Southern Unit	Total
Sawtimber trees:			
Sawlog portion	987.9	993.8	1,981.7
Upper-stem portion	195.3	209.0	404.3
All sawtimber trees	1,183.2	1,202.8	2,386.0
Poletimber trees	1,204.8	1,139.4	2,344.2
All growing-stock trees	2,388.0	2,342.2	4,730.2
Rough trees	330.2	504.5	834.7
Rotten trees	164.2	175.8	340.0
Total, all timber	2,882.4	3,022.5	5,904.9

Table 37.—Net volume of growing stock on commercial forest land, by tree classes, geographic units, and counties, Vermont, 1973

[In millions of cubic feet]

Unit and county	Sawtimber trees	Poletimber trees	Total growing stock
Caledonia	150.6	151.7	302.3
Essex	241.1	238.9	480.0
Franklin	89.0	101.8	190.8
Lamoille	146.1	146.5	292.6
Orange	172.8	179.6	352.4
Orleans	181.6	183.5	365.1
Washington	202.0	202.8	404.8
Northern Unit	1,183.2	1,204.8	2,388.0
Addison	143.6	132.9	276.5
Bennington	206.3	193.6	399.9
Chittenden	94.5	94.5	189.0
Rutland	237.1	225.7	462.8
Windham	242.2	231.1	473.3
Windsor	279.1	261.6	540.7
Southern Unit	1,202.8	1,139.4	2,342.2
Total	2,386.0	2,344.2	4,730.2

Table 38.—Net volume of growing stock and sawtimber on commercial forest land, by ownership classes, softwoods and hardwoods, and geographic units, Vermont, 1973

Ownership class	Growing stock (million cubic feet)			Sawtimber (million board feet)[a]		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
			NORTHERN UNIT			
National Forest	2.8	0.4	2.4	6.5	0.8	5.7
Other public	132.8	55.4	77.4	299.6	132.9	166.7
Forest industry	547.4	158.1	389.3	1,211.5	350.2	861.3
Farmer and other	1,705.0	884.9	820.1	3,374.8	1,811.8	1,563.0
All ownerships	2,388.0	1,098.8	1,289.2	4,892.4	2,295.7	2,596.7
			SOUTHERN UNIT			
National Forest	199.1	39.7	159.4	425.1	64.4	360.7
Other public	103.1	30.8	72.3	224.5	74.8	149.7
Forest industry	159.7	41.5	118.2	342.8	100.0	242.8
Farmer and other	1,880.3	507.2	1,373.1	3,835.9	1,340.6	2,495.3
All ownerships	2,342.2	619.2	1,723.0	4,828.3	1,579.8	3,248.5

[a] International ¼-inch rule.

Table 39.—Net volume of growing stock and sawtimber on commercial forest land, by stand-size classes, softwoods and hardwoods, and geographic units, Vermont, 1973

Stand-size class	Growing stock (million cubic feet)			Sawtimber (million board feet)[a]		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
NORTHERN UNIT						
Sawtimber stands	1,354.7	589.7	765.0	3,484.9	1,600.5	1,884.4
Poletimber stands	609.7	306.1	303.6	768.9	397.9	371.0
Other stands	423.6	203.0	220.6	638.6	297.3	341.3
All stands	2,388.0	1,098.8	1,289.2	4,892.4	2,295.7	2,596.7
SOUTHERN UNIT						
Sawtimber stands	1,458.7	425.8	1,032.9	3,666.8	1,188.1	2,478.7
Poletimber stands	638.3	118.8	519.5	768.4	213.1	555.3
Other stands	245.2	74.6	170.6	393.1	178.6	214.5
All stands	2,342.2	619.2	1,723.0	4,828.3	1,579.8	3,248.5

[a] International ¼-inch rule.

Table 40.—Net volume of growing stock on commercial forest land, by stand-size classes, geographic units, and counties, Vermont, 1973

Unit and county	Sawtimber stands	Poletimber stands	Other stands	Total	Sampling error of total
	Million cubic feet				*Percent*
Caledonia	164.6	76.2	61.5	302.3	9
Essex	285.8	125.7	68.5	480.0	7
Franklin	87.8	47.7	55.3	190.8	13
Lamoille	172.6	78.0	42.0	292.6	10
Orange	197.2	86.8	68.4	352.4	9
Orleans	208.8	90.8	65.5	365.1	9
Washington	237.9	104.5	62.4	404.8	8
Northern Unit	1,354.7	609.7	423.6	2,388.0	3
Addison	170.5	77.1	28.9	276.5	9
Bennington	249.2	114.0	36.7	399.9	7
Chittenden	109.9	50.8	28.3	189.0	13
Rutland	287.0	126.1	49.7	462.8	7
Windham	295.6	130.3	47.4	473.3	7
Windsor	346.5	140.0	54.2	540.7	7
Southern Unit	1,458.7	638.3	245.2	2,342.2	3
Total	2,813.4	1,248.0	668.8	4,730.2	2

Table 41.—Net volume of sawtimber on commercial forest land, by stand-size classes, geographic units, and counties, Vermont, 1973

Unit and county	Sawtimber stands	Poletimber stands	Other stands	Total	Sampling error of total
	— — — — — — *Million board feet*[a] — — — — — —				*Percent*
Caledonia	431.3	94.3	97.0	622.6	13
Essex	732.9	163.2	101.6	997.7	10
Franklin	225.5	54.1	86.9	366.5	17
Lamoille	441.9	101.3	61.5	604.7	14
Orange	504.3	107.4	102.2	713.9	13
Orleans	539.1	114.5	97.3	750.9	13
Washington	609.9	134.1	92.1	836.1	11
Northern Unit	3,484.9	768.9	638.6	4,892.4	5
Addison	433.5	90.9	47.6	572.0	12
Bennington	629.5	136.6	59.9	826.0	9
Chittenden	274.1	62.1	45.1	381.3	18
Rutland	718.7	152.6	79.9	951.2	10
Windham	741.0	158.1	75.9	975.0	10
Windsor	870.0	168.1	84.7	1,122.8	10
Southern Unit	3,666.8	768.4	393.1	4,828.3	5
Total	7,151.7	1,537.3	1,031.7	9,720.7	3

[a] International ¼-inch rule.

Table 42.—Net volume of growing stock on commercial forest land, by forest types, geographic units, and counties, Vermont, 1973

[In millions of cubic feet]

Unit and county	Forest type							Total
	White and red pine	Spruce/fir	Oak/pine	Oak/hickory	Elm/ash/red maple	Maple/beech/birch	Aspen/birch	
Caledonia	49.7	93.4	2.2	—	23.9	118.3	14.8	302.3
Essex	67.7	132.4	4.5	—	34.4	219.3	21.7	480.0
Franklin	35.3	60.3	1.0	—	19.7	65.3	9.2	190.8
Lamoille	41.0	80.2	2.7	—	21.9	133.1	13.7	292.6
Orange	54.6	101.1	3.2	—	27.8	151.8	13.9	352.4
Orleans	56.0	106.9	3.3	—	28.1	155.2	15.6	365.1
Washington	56.7	108.8	4.4	—	29.5	188.2	17.2	404.8
Northern Unit	361.0	683.1	21.3	—	185.3	1,031.2	106.1	2,388.0
Addison	40.7	19.2	6.0	—	32.5	162.3	15.8	276.5
Bennington	61.1	25.8	8.7	8.0	52.8	220.1	23.4	399.9
Chittenden	39.0	11.5	6.5	—	26.5	91.5	14.0	189.0
Rutland	78.1	29.7	12.0	4.1	62.3	248.6	28.0	462.8
Windham	88.8	27.6	12.3	39.9	67.9	208.0	28.8	473.3
Windsor	104.4	35.5	14.4	28.0	76.5	251.8	30.1	540.7
Southern Unit	412.1	149.3	59.9	80.0	318.5	1,182.3	140.1	2,342.2
Total	773.1	832.4	81.2	80.0	503.8	2,213.5	246.2	4,730.2

Table 43.—Net volume of sawtimber on commercial forest land, by forest types, geographic units, and counties, Vermont, 1973

[In millions of board feet][a]

Unit and county	Forest type							Total
	White and red pine	Spruce/ fir	Oak/ pine	Oak/ hickory	Elm/ash/ red maple	Maple/ beech/ birch	Aspen/ birch	
Caldeonia	117.7	170.3	4.5	—	37.0	276.7	16.4	622.6
Essex	169.3	231.9	10.9	—	50.7	507.3	27.6	997.7
Franklin	73.4	95.8	2.5	—	28.6	157.1	9.1	366.5
Lamoille	101.7	139.1	6.5	—	31.7	308.5	17.2	604.7
Orange	126.8	169.3	8.0	—	41.1	352.6	16.1	713.9
Orleans	134.8	187.5	7.8	—	41.5	360.8	18.5	750.9
Washington	135.8	186.9	9.6	—	43.8	438.2	21.8	836.1
Northern Unit	859.5	1,180.8	49.8	—	274.4	2,401.2	126.7	4,892.4
Addison	100.6	27.9	10.5	—	68.4	347.8	16.8	572.0
Bennington	148.2	41.5	17.4	17.5	113.4	461.2	26.8	826.0
Chittenden	95.5	21.7	9.7	—	57.0	184.4	13.0	381.3
Rutland	188.4	48.8	20.7	8.8	132.7	521.2	30.6	951.2
Windham	216.0	51.6	23.4	87.0	145.1	419.2	32.7	975.0
Windsor	255.0	64.5	25.2	60.9	161.7	521.5	34.0	1,122.8
Southern Unit	1,003.7	256.0	106.9	174.2	678.3	2,455.3	153.9	4,828.3
Total	1,863.2	1,436.8	156.7	174.2	952.7	4,856.5	280.6	9,720.7

[a] International ¼-inch rule.

Table 44.—Net volume of growing stock on commercial forest land in Northern geographic unit, by species and counties, Vermont, 1973

[In millions of cubic feet]

Species	Counties							North Uni
	Caledonia	Essex	Franklin	Lamoille	Orange	Orelans	Washington	
White and red pine	22.5	25.5	20.4	16.1	23.4	23.1	23.5	15
Balsam fir	40.6	60.1	26.4	35.8	47.4	47.9	50.3	30
Spruce	51.8	76.1	32.0	46.6	55.2	59.8	61.9	38
Hemlock	22.7	36.3	12.9	21.8	26.0	27.8	29.0	17
Other softwoods	11.1	14.7	6.8	8.9	10.9	11.7	11.8	7
Total softwoods	148.7	212.7	98.5	129.2	162.9	170.3	176.5	1,09
Select red oaks	.5	.5	.4	.3	.5	.4	.5	
Yellow birch	19.9	35.1	10.0	21.6	23.1	24.5	30.1	16
Paper birch	14.6	23.1	9.6	14.5	16.3	17.3	19.7	11
Sugar maple	61.1	109.3	35.0	66.6	76.3	78.5	93.7	52
Red maple	24.5	39.0	16.9	24.1	29.0	29.7	33.0	19
Beech	11.6	24.3	6.2	14.7	17.0	17.1	21.1	11
Ash	6.8	13.5	4.0	8.2	9.5	9.6	11.6	6
Aspen	7.4	11.2	5.4	6.6	9.2	8.9	9.3	5
Black cherry	1.5	3.1	.8	1.9	1.9	2.1	2.5	1
Other hardwoods	5.7	8.2	4.0	4.9	6.7	6.7	6.8	4
Total hardwoods	153.6	267.3	92.3	163.4	189.5	194.8	228.3	1,28
All species	302.3	480.0	190.8	292.6	352.4	365.1	404.8	2,38

Table 45.—Net volume of growing stock on commercial forest land in Southern geographic unit, by species and counties, Vermont, 1973

[In millions of cubic feet]

Species	Counties						Southern Unit
	Addison	Bennington	Chittenden	Rutland	Windham	Windsor	
te and red pine	22.0	33.4	23.9	43.4	50.3	59.6	232.6
am fir	5.8	5.9	1.8	6.3	3.8	5.6	29.2
ce	19.4	26.0	11.1	29.7	28.0	34.7	148.9
lock	20.9	32.9	16.0	38.7	43.6	50.0	202.1
r softwoods	.6	1.0	1.0	1.2	1.3	1.3	6.4
tal softwoods	68.7	99.2	53.8	119.3	127.0	151.2	619.2
ct red oaks	11.6	18.1	9.2	22.1	23.3	25.7	110.0
ow birch	23.9	31.0	10.4	34.2	30.4	37.5	167.4
r birch	19.5	28.3	14.3	33.7	33.6	37.6	167.0
r maple	70.8	100.8	42.5	113.0	110.7	124.9	562.7
maple	27.8	43.7	19.9	50.0	53.5	59.2	254.1
h	16.6	22.6	9.0	24.4	24.2	27.5	124.3
	13.8	20.2	10.0	23.6	23.9	26.6	118.1
n	8.3	12.3	8.0	15.3	16.2	17.1	77.2
k cherry	4.2	5.9	2.8	6.3	6.7	6.8	32.7
r hardwoods	11.3	17.8	9.1	20.9	23.8	26.6	109.5
tal hardwoods	207.8	300.7	135.2	343.5	346.3	389.5	1,723.0
l species	276.5	399.9	189.0	462.8	473.3	540.7	2,342.2

Table 46.—Net volume of sawtimber on commercial forest land in Northern geographic unit, by species and counties, Vermont, 1973

[In millions of board feet][a]

Species	Counties							Northern Unit
	Caledonia	Essex	Franklin	Lamoille	Orange	Orelans	Washington	
e and red pine	55.8	75.1	41.8	45.9	60.5	61.0	64.1	404.2
am fir	59.0	93.9	36.5	55.5	71.2	71.9	77.4	465.4
ce	117.8	161.8	65.9	97.7	114.3	128.4	129.0	814.9
lock	65.7	104.1	34.7	62.3	73.0	79.7	82.1	501.6
r softwoods	16.5	21.5	8.3	13.0	15.1	17.4	17.8	109.6
tal softwoods	314.8	456.4	187.2	274.4	334.1	358.4	370.4	2,295.7
t red oaks	1.8	1.9	1.3	1.0	1.8	1.7	1.8	11.3
w birch	47.3	84.7	23.9	51.8	56.5	59.5	73.8	397.5
r birch	13.6	22.8	7.0	13.9	15.5	16.7	19.2	108.7
r maple	138.5	242.6	82.6	147.9	171.7	176.8	208.8	1,168.9
maple	38.1	61.3	23.9	38.6	42.2	45.2	53.0	302.3
h	30.2	62.8	16.7	37.9	44.7	44.5	54.4	291.2
	12.9	24.9	7.3	15.1	17.1	17.5	21.3	116.1
n	7.6	12.4	4.7	7.3	9.7	9.5	11.0	62.2
k cherry	3.0	6.4	1.6	4.0	3.6	4.0	5.0	27.6
r hardwoods	14.8	21.5	10.3	12.8	17.0	17.1	17.4	110.9
tal hardwoods	307.8	541.3	179.3	330.3	379.8	392.5	465.7	2,596.7
species	622.6	997.7	366.5	604.7	713.9	750.9	836.1	4,892.4

nternational ¼-inch rule.

Table 47.—Net volume of sawtimber on commercial forest land in Southern geographic uni by species and counties, Vermont, 1973

[In millions of board feet][a]

Species	Counties						South Uni
	Addison	Bennington	Chittenden	Rutland	Windham	Windsor	
White and red pine	62.9	98.1	65.9	123.8	145.5	170.0	66
Balsam fir	2.6	3.4	2.0	4.0	3.3	4.6	1
Spruce	41.5	57.1	23.9	64.7	62.5	77.4	32
Hemlock	57.9	89.8	43.0	105.9	116.9	135.5	54
Other softwoods	1.8	2.8	2.8	3.1	3.7	3.4	1
Total softwoods	166.7	251.2	137.6	301.5	331.9	390.9	1,57
Select red oaks	31.2	51.5	22.4	60.3	66.2	72.1	30
Yellow birch	49.3	63.1	20.9	70.9	59.6	75.2	33
Paper birch	26.1	38.4	18.2	44.7	46.0	51.1	22
Sugar maple	150.7	208.6	84.3	233.1	222.9	256.9	1,15
Red maple	49.0	76.6	35.7	86.7	93.3	100.9	44
Beech	37.0	49.5	19.3	52.6	51.8	60.0	27
Ash	25.4	34.5	13.4	38.7	36.0	41.5	18
Aspen	10.4	15.5	8.8	18.5	19.0	19.3	9
Black cherry	5.5	8.0	4.2	9.2	9.3	10.4	4
Other hardwoods	20.7	29.1	16.5	35.0	39.0	44.5	18
Total hardwoods	405.3	574.8	243.7	649.7	643.1	731.9	3,24
All species	572.0	826.0	381.3	951.2	975.0	1,122.8	4,82

[a] International ¼-inch rule.

Table 48.—Net volume of growing stock on commercial forest land in Northern geographic unit, by species and diameter classes, Vermont, 1973

[In millions of cubic feet]

Species	All classes	(Diameter class (inches at breast height)									
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
White and red pine	154.5	27.3	31.5	17.1	16.7	15.9	10.6	11.2	6.1	16.1	2.0
Balsam fir	308.5	96.2	91.4	66.6	31.9	14.9	5.8	1.7	—	—	—
Spruce	383.4	83.8	96.0	84.0	54.0	31.8	19.7	6.6	4.1	3.4	—
Hemlock	176.5	23.6	27.3	37.9	31.4	27.2	10.6	7.7	7.9	2.9	—
Other softwoods	75.9	28.0	18.9	14.9	8.7	2.6	1.5	1.3	—	—	—
Total softwoods	1,098.8	258.9	265.1	220.5	142.7	92.4	48.2	28.5	18.1	22.4	2.0
Select red oaks	3.1	.1	—	.6	.1	.7	—	—	—	1.6	—
Yellow birch	164.3	20.7	23.1	28.9	20.6	24.5	18.8	11.2	7.1	6.9	2.5
Paper birch	115.1	26.3	36.7	25.9	12.8	7.5	4.3	1.6	—	—	—
Sugar maple	520.5	64.6	92.6	93.0	86.1	60.3	35.1	34.4	14.2	34.2	6.0
Red maple	196.2	32.3	41.9	48.0	34.4	18.4	10.7	5.4	3.3	1.4	.4
Beech	112.0	6.7	20.2	16.7	16.3	22.5	10.8	11.2	4.5	3.1	—
Ash	63.2	9.4	12.4	13.7	13.0	7.4	2.6	2.2	.7	1.3	.5
Aspen	58.0	14.6	17.0	11.4	4.9	6.9	2.6	.6	—	—	—
Black cherry	13.8	1.6	1.9	3.7	2.0	1.9	2.2	.4	.1	—	—
Other hardwoods	43.0	4.5	6.2	6.1	10.2	5.1	2.6	3.6	1.6	2.1	1.0
Total hardwoods	1,289.2	180.8	252.0	248.0	200.4	155.2	89.7	70.6	31.5	50.6	10.4
All species	2,388.0	439.7	517.1	468.5	343.1	247.6	137.9	99.1	49.6	73.0	12.4

Table 49.—Net volume of growing stock on commercial forest land in Southern geographic unit, by species and diameter classes, Vermont, 1973

[In millions of cubic feet]

Species	All classes	Diameter class (inches at breast height)									
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
White and red pine	232.6	31.1	35.7	42.7	30.4	29.9	27.2	17.5	5.6	11.0	1.5
Balsam fir	29.2	12.2	10.9	4.7	1.3	.1	—	—	—	—	—
Spruce	148.9	33.9	31.4	27.1	24.8	20.3	7.6	1.0	1.6	1.2	—
Hemlock	202.1	26.2	37.5	34.4	40.4	26.8	16.0	8.7	7.2	4.9	—
Other softwoods	6.4	1.2	.6	1.8	2.1	.7	—	—	—	—	—
Total softwoods	619.2	104.6	116.1	110.7	99.0	77.8	50.8	27.2	14.4	17.1	1.5
Select red oaks	110.0	7.8	14.6	14.3	18.0	21.1	12.3	12.1	5.6	2.8	1.4
Yellow birch	167.4	27.5	27.6	28.6	28.4	17.3	17.3	8.0	5.7	6.5	.5
Paper birch	167.0	39.4	36.8	34.6	25.6	14.6	7.2	3.8	1.5	3.5	—
Sugar maple	562.7	72.8	97.0	108.4	91.1	66.8	49.6	28.1	19.6	25.1	4.2
Red maple	254.1	42.5	54.2	46.4	43.2	30.2	16.7	7.5	4.6	8.0	.8
Beech	124.3	17.6	23.9	15.6	16.5	22.5	13.5	5.8	4.9	4.0	—
Ash	118.1	23.8	24.9	21.6	22.4	12.5	7.7	2.8	.2	2.1	.1
Aspen	77.2	14.2	20.1	20.0	10.9	6.8	2.2	1.5	.8	.7	—
Black cherry	32.7	5.5	5.8	9.6	5.3	1.6	1.6	1.6	1.2	.5	—
Other hardwoods	109.5	20.5	19.6	23.5	20.3	10.8	5.4	2.4	1.1	5.2	.7
Total hardwoods	1,723.0	271.6	324.5	322.6	281.7	204.2	133.5	73.6	45.2	58.4	7.7
All species	2,342.2	376.2	440.6	433.3	380.7	282.0	184.3	100.8	59.6	75.5	9.2

Table 50.—Net volume of sawtimber on commercial forest land in Northern geographic unit, by species and diameter classes, Vermont, 1973

[In millions of board feet][a]

Species	All classes	Diameter class (inches at breast height)							
		9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
White and red pine	404.2	60.1	64.5	65.0	47.6	49.5	28.9	78.6	10.0
Balsam fir	465.4	237.9	128.4	64.6	26.3	8.2	—	—	—
Spruce	814.9	299.6	220.8	137.8	89.7	30.8	19.9	16.3	—
Hemlock	501.6	131.6	126.2	112.5	47.2	33.3	37.2	13.6	—
Other softwoods	109.6	52.6	33.8	11.0	6.3	5.6	—	.3	—
Total softwoods	2,295.7	781.8	573.7	390.9	217.1	127.4	86.0	108.8	10.0
Select red oaks	11.3	—	.5	2.9	—	—	.1	7.8	—
Yellow birch	397.5	—	79.0	100.7	84.4	51.4	34.1	35.0	12.9
Paper birch	108.7	—	49.7	32.6	18.8	7.3	—	.3	—
Sugar maple	1,168.9	—	332.7	249.8	154.0	158.1	68.7	174.1	31.5
Red maple	302.3	—	130.7	74.9	46.7	25.0	15.8	7.1	2.1
Beech	291.2	—	62.0	93.6	47.4	51.4	21.7	15.1	—
Ash	116.1	—	50.2	32.1	11.6	10.3	3.2	6.2	2.5
Aspen	62.2	—	18.6	29.3	11.5	2.8	—	—	—
Black cherry	27.6	—	7.7	8.0	9.7	2.0	.2	—	—
Other hardwoods	110.9	—	39.0	21.1	11.1	16.6	7.6	10.2	5.3
Total hardwoods	2,596.7	—	770.1	645.0	395.2	324.9	151.4	255.8	54.3
All species	4,892.4	781.8	1,343.8	1,035.9	612.3	452.3	237.4	364.6	64.3

[a] International ¼-inch rule.

Table 51.—Net volume of sawtimber on commercial forest land in Southern geographic unit, by species and diameter classes, Vermont, 1973

[In millions of board feet] [a]

Species	All classes	Diameter class (inches at breast height)							
		9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
White and red pine	666.2	142.7	120.4	125.2	119.0	77.6	24.2	50.2	6.9
Balsam fir	19.9	15.2	4.5	.1	.1	—	—	—	—
Spruce	327.1	89.4	99.5	85.5	34.3	5.7	7.5	5.2	—
Hemlock	549.0	114.5	159.3	111.8	69.8	39.0	33.0	21.6	—
Other softwoods	17.6	6.0	8.3	3.2	.1	—	—	—	—
Total softwoods	1,579.8	367.8	392.0	325.8	223.3	122.3	64.7	77.0	6.9
Select red oaks	303.7	—	65.5	86.0	53.0	54.9	24.8	13.2	6.3
Yellow birch	339.0	—	101.8	69.5	74.9	36.2	24.6	29.8	2.2
Paper birch	224.5	—	92.5	59.3	31.9	17.4	6.7	16.7	—
Sugar maple	1,156.5	—	327.3	268.8	212.3	126.2	85.9	115.8	20.2
Red maple	442.2	—	156.9	119.6	70.5	32.4	20.4	38.5	3.9
Beech	270.2	—	59.3	89.1	57.5	24.8	21.4	18.1	—
Ash	189.5	—	81.0	51.0	32.9	12.9	.8	10.4	.5
Aspen	91.5	—	39.9	28.1	9.5	6.5	4.0	3.5	—
Black cherry	46.6	—	19.2	6.0	7.2	6.6	5.3	2.3	—
Other hardwoods	184.8	—	74.1	43.9	23.4	11.0	4.7	24.5	3.2
Total hardwoods	3,248.5	—	1,017.5	821.3	573.1	328.9	198.6	272.8	36.3
All species	4,828.3	367.8	1,409.5	1,147.1	796.4	451.2	263.3	349.8	43.2

[a] International ¼-inch rule.

Table 52.—Net volume of sawtimber on commercial forest land in Northern geographic unit, by species and standard-lumber log grades, Vermont, 1973

[In millions of board feet] [a]

Species	All classes	Standard-lumber log grades			
		Grade 1	Grade 2	Grade 3	Grade 4[b]
Softwoods:					
White pine	382.2	7.6	53.3	204.2	117.1
Red pine	22.0	2.7	4.4	11.7	3.2
Other softwoods[c]	1,891.5	—	—	—	—
Total softwoods	2,295.7	10.3	57.7	215.9	120.3
Hardwoods:					
Select red oaks	11.3	1.3	3.1	4.3	2.6
Yellow birch	397.5	47.1	105.6	208.4	36.4
Paper birch	108.7	8.9	32.4	53.9	13.5
Sugar maple	1,168.9	168.0	269.5	526.1	205.3
Red maple	302.3	5.2	58.7	166.7	71.7
Beech	291.2	5.8	50.8	164.6	70.0
Ash	116.1	10.9	33.6	51.0	20.6
Aspen	62.2	—	4.7	41.9	15.6
Black cherry	27.6	1.6	6.7	10.8	8.5
Other hardwoods	110.9	11.5	18.3	67.6	13.5
Total hardwoods	2,596.7	260.3	583.4	1,295.3	457.7
			(In percent)		
Hardwood quality	100	10	22	50	18

[a] International ¼-inch rule.

[b] Grade 4 applies only to the pines. For hardwoods the volumes in this column are for construction logs.

[c] Softwood species other than pine are not graded.

Table 53.—Net volume of sawtimber on commercial forest land in Southern geographic unit, by species and standard-lumber log grades, Vermont, 1973

[In millions of board feet][a]

Species	All classes	Standard-lumber logs			
		Grade 1	Grade 2	Grade 3	Grade 4[b]
Softwoods:					
White pine	613.2	4.2	38.9	298.8	271.3
Red pine	53.0	.3	.3	39.3	13.1
Other softwoods[c]	913.6	—	—	—	—
Total softwoods	1,579.8	4.5	39.2	338.1	284.4
Hardwoods:					
Select red oaks	303.7	53.0	68.0	136.6	46.1
Yellow birch	339.0	24.8	84.6	193.6	36.0
Paper birch	224.5	17.5	31.9	107.4	67.7
Sugar maple	1,156.5	112.4	264.4	574.0	205.7
Red maple	442.2	15.0	80.1	229.7	117.4
Beech	270.2	5.4	30.2	169.7	64.9
Ash	189.5	24.1	65.6	60.3	39.6
Aspen	91.5	2.7	11.4	51.5	25.9
Black cherry	46.6	2.0	9.7	23.9	11.0
Other hardwoods	184.8	10.5	30.6	102.0	41.7
Total hardwoods	3,248.5	267.4	676.4	1,648.7	656.0
			(In percent)		
Hardwood quality	100	8	21	51	20

[a] International ¼-inch rule.

[b] Grade 4 applies only to the pines. For hardwoods the volumes in this column are for construction logs.

[c] Softwood species other than pine are not graded.

METRIC EQUIVALENTS
OF UNITS USED IN THIS REPORT

1 acre = 4,046.86 square meters or 0.405 hectare.
1,000 acres = 405 hectares.
1,000,000 acres = 405,000 hectares.
1,000 board feet (International ¼-inch log rule) = 3.48 cubic meters.
1,000,000 board feet (International ¼-inch log rule) = 3,480 cubic meters.
Breast height = 1.4 meters above ground level.
1 cubic foot = 28,317 cubic centimeters or 0.028317 cubic meter.
1,000 cubic feet = 28.317 cubic meters.
1,000,000 cubic feet = 28,317 cubic meters.
1 cord (wood, bark, and airspace) = 3.6246 cubic meters.
1 cord (solid wood, pulpwood) = 2.4069 cubic meters.
1 cord (solid wood, other than pulpwood) = 2.2654 cubic meters.
1,000 cords (pulpwood) = 2,406.9 cubic meters.
1,000 cords (other products) = 2,265.4 cubic meters.
1 foot = 30.48 centimeters or 0.3048 meter.
1 inch = 25.4 millimeters or 2.54 centimeters or 0.0254 meter.
1 mile = 1.609 kilometers.
1 square foot = 929.03 square centimeters or 0.0929 square meter.

Kingsley, Neal P.
1977. **The forest resources of Vermont.** Northeast. For. Exp. Stn., Upper Darby, Pa.
58 p., illus. (USDA For. Serv. Resour. Bull. NE-46)

A statistical and analytical report of the third forest survey of Vermont by the USDA Forest Service. Statistical findings are based on the remeasurement of 1/5-acre plots and 10-point cluster plots. This report discusses and analyzes trends in forest-land area, timber volume, annual growth, and timber removals. Timber-products output by forest industries, based upon a canvass of industries in 1973, and the importance of timber and forests to the State's economy and environment are also discussed. The report also includes a discussion of the outlook for timber supplies during the next 30 years and forest-management opportunities in the State. Also included are 53 tables of statistical data.

(743)—905.2

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(743)—905.2

METRIC EQUIVALENTS
OF UNITS USED IN THIS REPORT

1 acre = 4,046.86 square meters or 0.405 hectare.
1,000 acres = 405 hectares.
1,000,000 acres = 405,000 hectares.
1,000 board feet (International ¼-inch log rule) = 3.48 cubic meters.
1,000,000 board feet (International ¼-inch log rule) = 3,480 cubic meters.
Breast height = 1.4 meters above ground level.
1 cubic foot = 28,317 cubic centimeters or 0.028317 cubic meter.
1,000 cubic feet = 28.317 cubic meters.
1,000,000 cubic feet = 28,317 cubic meters.
1 cord (wood, bark, and airspace) = 3.6246 cubic meters.
1 cord (solid wood, pulpwood) = 2.4069 cubic meters.
1 cord (solid wood, other than pulpwood) = 2.2654 cubic meters.
1,000 cords (pulpwood) = 2,406.9 cubic meters.
1,000 cords (other products) = 2,265.4 cubic meters.
1 foot = 30.48 centimeters or 0.3048 meter.
1 inch = 25.4 millimeters or 2.54 centimeters or 0.0254 meter.
1 mile = 1.609 kilometers.
1 square foot = 929.03 square centimeters or 0.0929 square meter.

Headquarters of the Northeastern Forest Experiment Station are in Upper Darby, Pa. Field laboratories and research units are maintained at:

- Amherst, Massachusetts, in cooperation with the University of Massachusetts.
- Beltsville, Maryland.
- Berea, Kentucky, in cooperation with Berea College.
- Burlington, Vermont, in cooperation with the University of Vermont.
- Delaware, Ohio.
- Durham, New Hampshire, in cooperation with the University of New Hampshire.
- Hamden, Connecticut, in cooperation with Yale University.
- Kingston, Pennsylvania.
- Morgantown, West Virginia, in cooperation with West Virginia University, Morgantown.
- Orono, Maine, in cooperation with the University of Maine, Orono.
- Parsons, West Virginia.
- Pennington, New Jersey.
- Princeton, West Virginia.
- Syracuse, New York, in cooperation with the State University of New York College of Environmental Sciences and Forestry at Syracuse University, Syracuse.
- Warren, Pennsylvania.

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by James T. Bones
and Ralph P. Glover, Jr.

USDA FOREST SERVICE RESOURCE BULLETIN NE-47
1977

FOREST SERVICE, U. S. DEPARTMENT OF AGRICULTURE
NORTHEASTERN FOREST EXPERIMENT STATION
6816 MARKET STREET, UPPER DARBY, PA. 19082

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MANUSCRIPT RECEIVED FOR PUBLICATION 7 JUNE 1976

COVER PHOTO

West Virginia still has an abundance of relatively small sawmills which manufacture rough wood products for local use. Mr. Ordin S. Roby, sawyer at this mill near Morgantown, West Virginia, has been sawing logs for about a half century. He was producing headers and other mine timbers for a nearby coal mine and rustic fencing.

The Timber Industries of West Virginia

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HIGHLIGHTS

THE 1974 TIMBER-INDUSTRY survey in West Virginia showed that since 1965:

★ Total roundwood output of industrial products has declined by 19 percent to 106.6 million cubic feet.

★ Sawlog production has declined by 14 percent to 464 million board feet.

★ Pulpwood production has declined by 33 percent to 214 thousand cords.

★ Veneer-log production has declined by 38 percent to 3.2 million board feet.

★ Cooperage log and bolt production has declined by 35 percent to 3.2 million board feet.

★ The number of sawmills has declined from 505 to 365.

Round timber conversions for major products:
Softwood logs: M bf (Int. 1/4-inch) = 167.1 ft^3 = 4.73 M^3
Hardwood logs: M bf (Int. 1/4-inch) = 155.4 ft^3 = 4.40 M^3
Pulpwood: 1 Std. cord = 85 ft^3 = 2.41 M^3

BACKGROUND

The Forest Service of the U.S. Department of Agriculture conducts continuing forest surveys of all states to provide up-to-date information about the timber and other related resources of the Nation. In the 14-state region served by the Northeastern Forest Experiment Station, all states have now been surveyed at least twice. West Virginia has now been inventoried for the third time. A part of the current survey included a timber-industry survey to determine the output of timber products, and the volume and disposition of primary manufacturing residues.

This report is the result of a 100-percent canvass of all primary wood manufacturers that were operating in West Virginia in 1974. Pulpwood production data were gathered as part of the Station's annual survey of pulpwood producers in the Northeast. The primary wood manufacturers first received a questionnaire that was mailed from the Experiment Station headquarters. If a mill owner failed to respond after three mailings, he was contacted in person by a member of the West Virginia Department of Natural Resources (DNR). The authors thank West Virginia's primary manufacturers for their excellent cooperation, and the DNR personnel who assisted in contacting nonrespondents.

This report deals mostly with statistics for 1974, the calendar year of the current timber industry survey, and 1965, the calendar year of the previous complete survey. The reader is reminded that these years may or may not be representative for the various timber industries in West Virginia that are covered in this report. When documented production statistics were available for individual timber products for previous or intervening years, they were included for comparisons.

Long-term production trends will only be forthcoming from repeated surveys in the future. Until a data base is built up over time, the reader is cautioned to use the current statistics prudently.

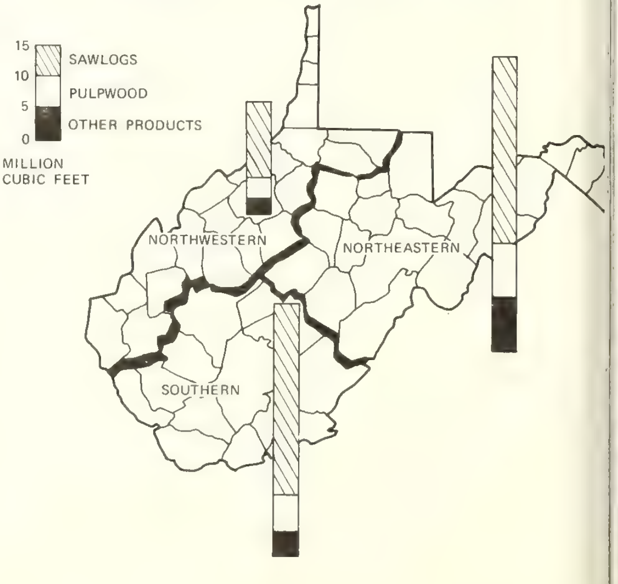
CURRENT INDUSTRY TRENDS

The key to improving timber utilization in West Virginia is recovering a greater volume of wood from each forested acre. When harvesting solid wood products, more topwood, small-diameter tree boles, and sound sections of defective trees must be recovered and converted into industrial products. Currently in West Virginia there are five sawmill operators using scragg mills to handle this material. Other mill men have shown much interest in using these scragg mills.

New technology is being developed for harvesting fiber products. These total-tree harvesting systems are ideally suited for conversion of hardwood stands to even-age management without the unsightly appearance of logging residues, and for forest land-clearing projects. After felling, the entire tree (including branches and top) is yarded to a central location where it is fed into a chipper. The unbarked chips are blown into a van for shipment to the pulpmill. Forest researchers claim that this new system can increase the wood-fiber yield per acre by 25 to 60 percent over conventional pulpwood harvesting methods, depending upon the volume of cull and small-diameter trees in the stand. This increase in wood-fiber recovery makes it profitable to harvest many stands that were previously passed over as too costly to harvest by conventional methods.

Public pressure, more stringent pollution-abatement regulations, and threats of strict harvesting regulations are stimulating research in specialized timber-harvesting equipment. The

Figure 1.—Harvest of industrial wood in West Virgini by regions and major products, 1974.



skyline logging system recently returned to West Virginia for trial use on large forest tracts. This system is considered prohibitively expensive for harvesting small tracts, or for use in areas that require frequent shifts in equipment. If small, more efficient prototypes can be developed, they may be used more extensively in West Virginia. The advantages of this system are that there is less physical disturbance to the logged-over area, and a smaller area is required for access logging roads.

In anticipation of the revitalizing and upgrading of the eastern rail systems, and increasing demand for pressure-treated mine materials, the number of treating plants in West Virginia has nearly tripled in the last decade; treating capacity has doubled. Many of the new plants have been small, single-unit installations.

INDUSTRY OVERVIEW

Forest industries used nearly 107 million cubic feet of roundwood from the timberlands of West Virginia in 1974. Hardwood species accounted for more than 89 percent of this volume. Sawlogs were the major roundwood product, accounting for two-thirds of the total harvest in West Virginia. Pulpwood production ranked second in volume—even though there are no woodpulp mills operating in the State. Other products that made up a minor portion of the harvest were cooperage and veneer logs, mine timbers, posts, poles, handle stock, and fence rails.

The total industrial roundwood harvest in West Virginia decreased by 19 percent since the last industry survey was made in 1965 *(Kingsley 1968)*. While the sawlog harvest declined by only 14 percent, pulpwood, mine timber, and cooperage and veneer log output each dropped more than 30 percent. The softwood harvest declined by 12 percent, while the hardwood harvest declined by 20 percent.

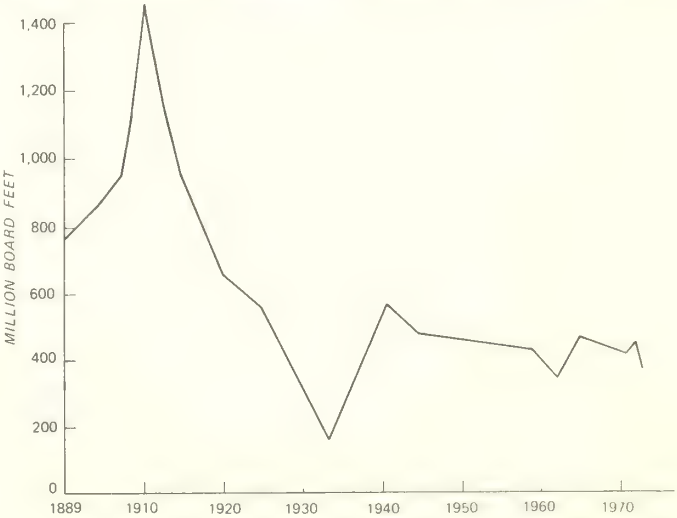
In 1974, more of the industrial roundwood harvest came from West Virginia's Northeastern Region than from the other two regions (fig. 1). The 47 million cubic-foot harvest represented 44 percent of the total. Though the Southern Region ranked second in total roundwood volume harvested—42 million cubic feet—a greater volume of sawlogs was harvested in this region than any other region. Nicholas, Fayette, and Greenbrier Counties each accounted for more than 25 million board feet of sawlogs in 1974.

LUMBER AND SAWLOGS

West Virginia has been an important hardwood lumber-producing state for a century. When the lumber industry was becoming established in West Virginia after the Civil War, softwood lumber production exceeded that of hardwoods. But by 1879, hardwood lumber accounted for 113 million board feet of the 180 million board feet that was produced. Since then, hardwood lumber manufacture has dominated the industry.

In 1907, more than a billion board feet of lumber was being sawed annually in West Virginia, 64 percent from hardwoods (fig. 2). By 1910, West Virginia produced more hardwood lumber than any other state. Total lumber production remained over the billion-board-foot level in West Virginia until 1917, when production dropped to 810 million board feet. This downward trend continued until the Depression; in 1933 total production dropped to 185 million board feet, the lowest since 1880. During World War II, production climbed; 578 million board feet was produced in 1941. Since then, lumber production has averaged about 425 million

Figure 2.—Lumber production in West Virginia, 1889-1974. Sources: Steer, Henry. 1948. Lumber production in the United States, 1799-1946. U.S. Dep. Agric. Misc. Pub. 669. 233 p.; Lumber production statistics. U.S. Dep. Commer., Wash., D.C.



board feet per year. In 1974, 381 million board feet of lumber was produced, 95 percent from hardwoods.

The number of sawmills operating in West Virginia has closely paralleled fluctuations in lumber production. As lumber demand slackened and production dropped, fewer sawmills operated. During the first decade of this century, when historic production levels were being reached, the number of sawmills operating in West Virginia exceeded 1,500. Many small producers responded again to the increased demand during World War II; in 1942, 1,558 sawmills were known to have operated. Since that time the number of operating mills has declined. From 1965 to 1974, the number of sawmills in West Virginia decreased from 505 to 365.

Hansen and Warder (1967) observed that a pattern toward greater stability had developed within the industry. This was exemplified by a steady decline in small-scale operations, an increase in average size, a leveling-off in total output, and an increasing number of mills that operated all year. The study also found that the percentage of sawmills near improved roads had grown from 68 percent in 1958 to 81 percent in 1967, and that maximum distances for hauling sawlogs (from the woods to the mill) had increased from a range of 10 to 36 miles to a range of 18 to 110 miles. In the eastern United States, improved transportation routes tend to increase the size of raw-material procurement areas, increase product marketing capabilities, and encourage the development of high-capacity production facilities.

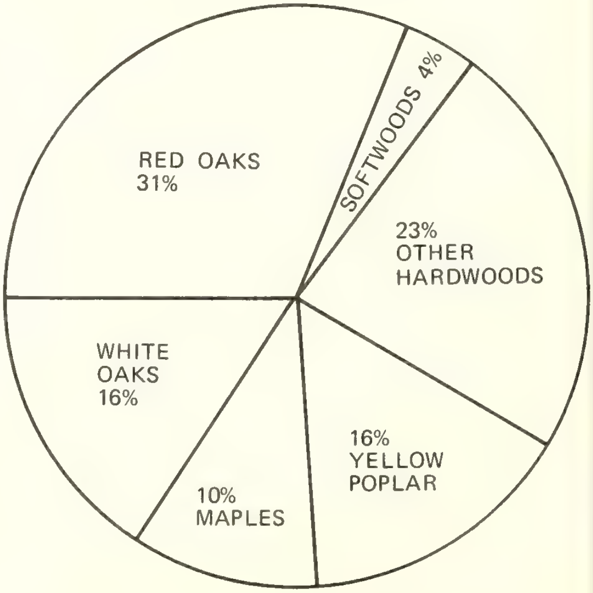
While sawlog production from West Virginia timberlands decreased by 5 percent—464 million board feet—from 1965 to 1974, log receipts at sawmills decreased by 8 percent (table 5). Only the Northwestern Region reflected increases in both sawlog production and receipts, up 26 percent and 17 percent, respectively, during the past 10 years. The Southern Region experienced the greatest losses in both production and receipts.

In 1974, the Southern and Northwestern regions were net exporters of sawlogs, while the Northeastern Region was a net importer. Over 7 million board feet of sawlogs were shipped from the Southern Region to other regions within West Virginia and nearly 6 million board feet of sawlogs were shipped to other states. Only 2 million board feet of sawlogs were imported from other regions and states. In the Northwestern Region of West Virginia, more than 26 percent of the harvested sawlog volume was shipped to other regions or states for manufacture. Only 11 percent of the logs sawed in the region came from other regions or states. In the Northeastern Region, only 14 million board feet of the 186 million produced in 1974 was exported to other regions and states. More than 22 million board feet of sawlogs, however, were imported to supplement local sawmill requirements.

Statewide, West Virginia was a net exporter of sawlogs in 1974. Nearly 28 million board feet of sawlogs were shipped to neighboring states for manufacture. Pennsylvania and Virginia were major recipients of West Virginia sawlogs, receiving 11 million and 9 million board feet, respectively. More than 11 million board feet of sawlogs were imported by West Virginia mills. Maryland was the major out-of-state sawlog source, supplying more than 6 million board feet in 1974.

Oak accounted for nearly half of the total sawlog production in 1974; red oaks alone accounted for 31 percent of the total (fig. 3). Other important hardwood species included white oaks, maple, and yellow-poplar. Softwood species accounted for only 4 percent of the total harvest.

Figure 3.—West Virginia sawlog production, by species in 1974, in percent.



Yellow pine and hemlock were the most important softwoods harvested.

PULPWOOD

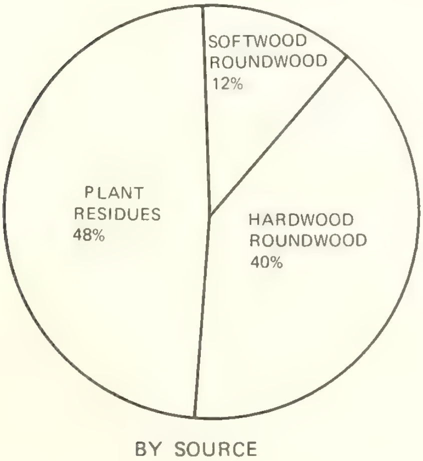
Though at least six pulpmills have operated in West Virginia over the years, none are presently in operation. The first known pulpmill was established in 1886 at Harpers Ferry. A second pulpmill, constructed at West Piedmont, was determined to be in the State of Maryland after a boundary dispute between the two States. Other pulpmills were constructed at Davis in 1895, at Parsons in 1902, and at Richwood. The Richwood mill, the last operating mill, closed in the early 1930s. The Depression and competition from newer pulpmills were major reasons for the mill closure. No pulpmills have been established in West Virginia since the Depression; no doubt, the proximity of pulping facilities in Maryland, Virginia, Ohio, and Pennsylvania have worked against the development of a local industry. However it is reasonable to assume that the woodpulp industry will move into West Virginia as demand for paper products continues to climb in the eastern United States. The State has sufficient timber resources to support a pulpmill.

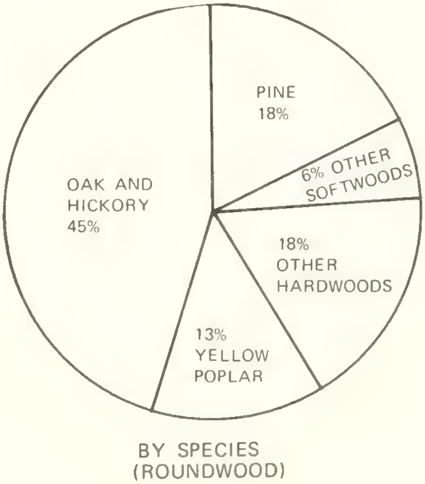
Nearly 214,000 cords of pulpwood were harvested from West Virginia timberlands in 1974, and more than 198,000 cord equivalents of pulp chips were recovered from the primary wood manufacturing plants in the State. Though the volume of wood from plant residues is at a record high, the total roundwood harvest has decreased during the last decade. Since 1965, the roundwood harvest from softwoods has declined by 50 percent and the harvest from hardwoods has declined by 25 percent. During the same period, chip production from plant residues has climbed 115 percent from more 92 thousand cord equivalents in 1965 to 198 thousand cord equivalents.

In 1974, softwood trees accounted for 12 percent of the production total, hardwood trees accounted for 40 percent (fig. 4). Pulp chips from manufacturing residues accounted for the remaining 48 percent. Most of the softwood harvest was pine. Most of the hardwood harvest—45 percent of the roundwood total—was oak and hickory. Yellow-poplar made up 13 percent of the total.

Nearly 762,000 cords of softwood roundwood and 1.9 million cords of hardwood roundwood were harvested for pulpwood from West Virginia timberlands in the past decade. More than 63 percent of the softwood and 66 percent of the hardwood came from the Northeastern Region of West Virginia. The Northeastern Region, however, decreased in importance as a pulpwood producing region from 1965 to 1974. In 1965, two-thirds of the total harvest came from the Northeastern Region; in 1974, the region accounted for less than half of the pulpwood harvest.

Figure 4.—West Virginia pulpwood production in 1974, in percent.





OTHER TIMBER PRODUCTS

Veneer Logs and Bolts

Nearly 3.2 million board feet of veneer logs were harvested in West Virginia in 1974. This volume represents a 38-percent decrease in production since 1965, when 4.6 million board feet of logs were harvested. Though West Virginia has four veneer mills, a high percentage of the State's veneer-log harvest is exported to other states for manufacture. West Virginia veneer manufacturers are also large importers of wood from other states. This is because the species of quality veneer logs that are harvested in West Virginia are not always compatible with the needs of local secondary manufacturers. For example, West Virginia veneer manufacturers have purchased hard maple and yellow birch from Vermont, white ash and black cherry from Pennsylvania, and yellow-poplar and gum from Maryland. At the same time, West Virginia timber harvesters have shipped black walnut to Ohio and hickory to Tennessee for manufacture. In 1974, 2.6 million board feet of veneer logs were exported from West Virginia and 3.7 million board feet were imported. Wood receipts of West Virginia's four veneer mills totaled 4.3 million board feet in 1974.

Comparisons for selected years can be made with the following statistics:

Year	*Operating plants*	*Production*	*Receipts*
	(number)	*(million board feet)* [a]	
1963	5	7.0	6.3
1965	6	4.6	6.4
1968	6	7.9	8.7
1972	4	4.3	6.1

---

a International 1/4-inch rule.

Production and receipts of veneer logs in West Virginia peaked in 1968. Since then, plant closures have adversely affected both production and receipts.

Changing preferences of consumers and the availability of suitable high-quality logs have affected the species distribution of the veneer-log harvest over the years. Important veneer species harvested from West Virginia timberlands during the last decade indicate past trends:

Year	*Species*	*Harvest*	*Portion of total harvest*
		(million bd. ft.) [a]	*(percent)*
1963	Yellow-poplar	4.8	69
	Red oak	0.7	10
	Black walnut	0.7	9
1974	Yellow-poplar	1.1	35
	Hickory (pecan)	0.9	28
	Red oak	0.6	20

---

a International 1/4-inch rule

Yellow-poplar was the dominant species harvested in 1963, accounting for 69 percent of the total harvest. By 1974, though yellow-poplar was still the volume leader, the percentage of harvested hickory and red oak had increased, and black walnut had declined in importance.

Cooperage

Tight cooperage for bourbon barrels has been an important use of white oak in West Virginia for many years. Large, high-quality white oak sawtimber is needed to produce the clear defect-free staves that are required.

In 1953, there were five stave mills operating in West Virginia. In 1974, five mills were again in operation.

The following cooperage log-and bolt-production statistics show the volume of white oak harvested in West Virginia for staves in recent years:

Year	*Production*
	(million board feet)
1949	6.7
1952	3.2
1960	1.5
1965	4.4
1974	3.2

In the past, many of the cooperage mills in West Virginia were portable and were shifted from county to county to take advantage of local markets and the high-quality timber that was available. As extensive stands of quality white oak were more difficult to find, the number of mills diminished and those that operated became stationary. Some were integrated with sawmill operations. The raw material for these operations was delivered in either bolt or log form. The logs were sawed into heading material or cut into 38-inch lengths and split into stave bolts. The standard measure for these bolts is bolt-feet—the chord distance across the end of the bolt from sapwood to sapwood. One bolt-foot is equivalent to about 10 to 12 board feet.

Rustic Fencing

West Virginia's rustic fencing industry produces two- and three-rail fences that are used by home and estate owners, principally in the suburban areas of the Atlantic Seaboard states. A decade ago, fencing mills were characterized as requiring little manufacturing equipment and considerable hand labor. The preferred species was American chestnut, which had been killed when the chestnut blight swept through the eastern United States.

As indicated by the following statistics, total production has risen in West Virginia:

Year	*Softwoods*		*Hardwoods*	
	Posts	*Rails*	*Posts*	*Rails*
	(thousand pieces)		*(thousand pieces)*	
1965	8	—	238	477
1974	89	912	582	577

Today, most fencing producers in West Virginia have high-production mill facilities and use black locust and sassafras for posts, and spruce and sassafras for rails.

Many of the posts used for rustic fencing, however, are still cut by farmers and other rural residents during slack periods, and many rails are produced by sawmills that also produce rough lumber and shoring timber for mines.

MANUFACTURING RESIDUES

Woodpulp mills, charcoal producers, and other industries that depend upon inexpensive sources of wood are becoming increasingly dependent on primary manufacturing residues as a major source of raw material. More stringent air and water pollution laws are also making open burning and dumping of residue unacceptable and encouraging manufacturers to seek uses for residues.

Nearly 45 million cubic feet of residues were generated by primary wood manufacturers in West Virginia in 1974. Thirty-six million cubic feet of this total was woody material and 9 million cubic feet was bark. About 22 million cubic feet of the woody residue was suitable for conversion into chips for fiber products. Seventy-four percent of all residues—33 million cubic feet—was recovered and used. Only 65 percent of the bark residue was used, but 76 percent of the wood residue was used.

When the results of the 1974 study in West Virginia were compared to a similar study (*Kingsley 1968*) made in 1965, some important trends were identified (fig. 5).

- The volume of manufacturing residues used in 1974 was 25 percent greater than the volume used in 1965.
- The volume of manufacturing residues used for fiber-product chips in 1974 was 26 percent greater than that in 1965.
- The volume of manufacturing residues used for fuel—both industrial and domestic—in 1974 was 11 percent greater than that used in 1965.
- The volume of manufacturing residues used for such products as metallurgical chips and charcoal in 1974 was 10 percent greater than that used in 1965.

Figure 5.—Trends in manufacturing residue use in West Virginia, 1965 and 1974.

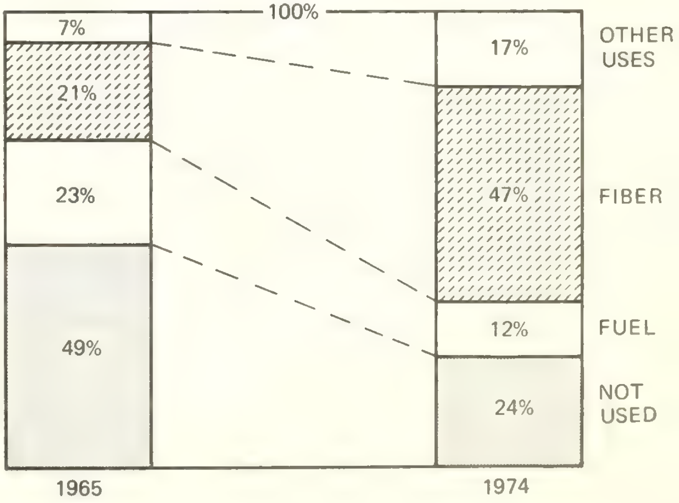


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Table 1.—Volume of industrial roundwood by products harvested in West Virginia in 1974

Product	Standard unit	Volume in standard units			Roundwood volume		
		All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
					Thousand cubic feet		
Sawlogs	M board feet[a]	463,697	17,276	446,421	72,242	2,887	69,355
Pulpwood	Standard cords	213,600	50,800	162,800	18,156	4,318	13,838
Veneer logs	M board feet[a]	3,163	—	3,163	491	—	491
Cooperage logs	M board feet[a]	3,167	—	3,167	492	—	492
Mine timbers	M cubic feet	6,742	550	6,192	6,742	550	6,192
Misc. products[b]	M cubic feet	8,488	3,884	4,604	8,488	3,884	4,604
					106,611	11,639	94,972

[a] International 1/4-inch rule.
[b] Includes posts, poles, handle stock, and fence rails.

Table 2.—Change in timber output from roundwood in West Virginia between 1965 and 1974

Product	All species			Softwoods			Hardwoods		
	1965	1974	Change	1965	1974	Change	1965	1974	Change
	Million cubic feet		*Percent*	*Million cubic feet*		*Percent*	*Million cubic feet*		*Percent*
Sawlogs	84.5	72.2	-14	3.6	2.9	-19	80.9	69.3	-14
Pulpwood	27.1	18.2	-33	8.7	4.3	-50	18.4	13.9	-25
Veneer logs	.8	.5	-38	—	—	—	.8	.5	-38
Cooperage logs	.8	.5	-35	—	—	—	.8	.5	-35
Mine timbers	11.0	6.7	-39	.9	.5	-39	10.1	6.2	-39
Misc. products[b]	7.8	8.5	+8	(a)	3.9	(a)	7.8	4.6	-41
Total	132.0	106.6	-19	13.2	11.6	-12	118.8	95.0	-20

[a] Less than 50,000 cubic feet. Change not calculated.
[b] Includes posts, poles, handlestock, charcoal, and fence rails.

Table 3.—Industrial roundwood harvest [a] in West Virginia by geographic regions, species groups, and products, 1974

[In thousands of cubic feet]

Geographic region and species group	Product			All products
	Sawlogs	Pulpwood	Other products [b]	
Northeastern:				
Softwood	1,254	2,431	3,749	7,434
Hardwood	27,751	6,587	5,317	39,655
Total	29,005	9,018	9,066	47,089
Southern:				
Softwood	1,412	484	352	2,248
Hardwood	29,651	5,483	4,376	39,510
Total	31,063	5,967	4,728	41,758
Northwestern:				
Softwood	221	1,403	333	1,957
Hardwood	11,953	1,768	2,086	15,807
Total	12,174	3,171	2,419	17,764
All regions:				
Softwood	2,887	4,318	4,434	11,639
Hardwood	69,355	13,838	11,779	94,972
Total	72,242	18,156	16,213	106,611

[a] Does not include fuelwood or removals not manufactured into industrial products.

[b] Includes cooperage and veneer logs, mine timbers, handle stock, posts, pilings, and fense rails.

Table 4.—Number of sawmills in West Virginia by geographic regions and annual production classes, 1965 and 1974

Region	Production class [a]							
	Greater than 1 million board feet		Less than 1 million board feet		Idle and custom mills		Total	
	1965	1974	1965	1974	1965	1974	1965	1974
Northeastern	55	37	78	53	94	43	227	133
Northwestern	18	15	59	62	54	78	131	155
Southern	51	38	35	22	61	17	147	77
All regions	124	90	172	137	209	138	505	365

[a] Based upon the volume of sawlog receipts during calender years 1965 and 1974.

Table 5.—Sawlog production and receipts relationships in West Virginia by species groups and geographic regions between 1965 and 1974

Species group and geographic regions	Production			Receipts		
	1965	1974	Change	1965	1974	Change
	Million board feet [a]	*Million board feet* [a]	*Percent*	*Million board feet* [a]	*Million board feet* [a]	*Percent*
Softwoods:						
Northeastern	9.0	7.5	- 17	9.1	6.7	- 26
Southern	10.4	8.5	- 18	10.3	7.9	- 23
Northwestern	.8	1.3	+62	.7	1.3	+86
All regions	20.2	17.3	- 14	20.1	15.9	- 21
Hardwoods:						
Northeastern	192.3	178.6	- 7	193.9	188.1	- 3
Southern	217.0	190.9	- 12	217.1	180.0	- 17
Northwestern	61.2	76.9	+26	54.3	63.3	+17
All regions	470.5	446.4	- 5	465.3	431.4	- 7
All species	490.7	463.7	- 5	485.4	447.3	- 8

[a] International 1/4-inch rule.

Table 6.—Sawlog production and receipts in WEST VIRGINIA, by species and destination of shipments, 1974

[In millions of board feet, International 1/4-inch rule]

Species	Cut and retained in state	Exported to:			Total production	Imported from:			Total receipts
		Pennsylvania	Virginia	Other states		Maryland	Virginia	Other states	
Hemlock	5.0	—	—	—	5.0	(a)	0.2	—	5.2
Yellow pine	4.1	—	0.3	—	4.4	(a)	—	(a)	4.1
Other pines	3.5	—	—	—	3.5	0.1	.1	(a)	3.7
Other softwoods	2.9	—	1.5	—	4.4	(a)	(a)	—	2.9
Total softwoods	15.5	—	1.8	—	17.3	0.1	0.3	(a)	15.9
Ash	7.9	0.3	.1	0.1	8.4	.3	(a)	0.1	8.3
Basswood	16.3	.2	—	(a)	16.5	.2	.1	.1	16.7
Beech	19.5	(a)	.5	.4	20.4	(a)	(a)	.3	19.8
Black cherry	12.5	.4	—	.1	13.0	.5	(a)	.1	13.1
Hickory	21.6	(a)	.8	.6	23.0	.2	.1	.3	22.2
Red maple	16.7	.9	.2	.2	18.0	.3	(a)	.2	17.2
Sugar maple	27.4	.4	.2	.6	28.6	.3	.1	.2	28.0
White oak	33.2	1.8	.2	1.1	36.3	.7	(a)	.4	34.3
Chestnut oak	36.1	.6	1.0	1.3	39.0	.4	.6	.2	37.3
Northern red oak	87.2	3.0	1.4	1.1	92.7	1.2	.1	.7	89.2
Other red oaks	48.5	1.4	1.2	1.0	52.1	.7	.2	.5	49.9
Yellow-poplar	71.0	1.6	1.3	1.1	75.0	1.2	.3	.3	72.8
Other hardwoods [b]	22.5	.5	.3	.1	23.4	(a)	.1	(a)	22.6
Total hardwoods	420.4	11.1	7.2	7.7	446.4	6.0	1.6	3.4	431.4
All species	435.9	11.1	9.0	7.7	463.7	6.1	1.9	3.4	447.3

[a] Less than 50,000 board feet.

[b] Includes sweet and yellow birch, cucumber tree, elm, gum, and black walnut.

Table 7.—Sawlog production and receipts in the NORTHEASTERN REGION of West Virginia, by species and destination of shipments, 1974

[In millions of board feet, International 1/4-inch rule]

Species	Cut and retained in region	Out-shipments		Total production	In-shipments		Total receipts
		To other regions	To other states		From other regions	From other states	
Hemlock	1.5	—	—	1.5	0.2	0.2	1.9
White pine	.8	—	—	.8	.1	.1	1.0
Other pines	1.1	—	—	1.1	.1	(a)	1.2
Spruces	2.2	—	1.5	3.7	(a)	(a)	2.2
Other softwoods	.4	—	—	.4	(a)	(a)	.4
Total softwoods	6.0	—	1.5	7.5	0.4	0.3	6.7
Ash	4.1	0.1	.3	4.5	.3	.3	4.7
Basswood	7.2	(a)	.2	7.4	.7	.4	8.3
Beech	6.6	.1	.2	6.9	.6	.2	7.4
Birch	1.6	(a)	.1	1.7	.2	(a)	1.8
Black cherry	9.7	.1	.2	10.0	.6	.5	10.8
Hickory	6.7	.2	.3	7.2	.7	.5	7.9
Red maple	8.4	.1	.6	9.1	.7	.5	9.6
Sugar maple	13.5	.1	.6	14.2	1.2	.5	15.2
White oak	12.5	.2	1.1	13.8	.7	.8	14.0
Chestnut oak	12.3	.2	1.5	14.0	1.2	1.0	14.5
Northern red oak	38.1	.2	2.3	40.6	2.1	1.6	41.8
Other red oaks	14.6	.3	1.3	16.2	.9	1.0	16.5
Yellow-poplar	25.1	.1	1.3	26.5	2.6	1.4	29.1
Other hardwoods[b]	6.0	.3	.2	6.5	.4	.1	6.5
Total hardwoods	166.4	2.0	10.2	178.6	12.9	8.8	188.1
All species	172.4	2.0	11.7	186.1	13.3	9.1	194.8

[a] Less than 50,000 board feet.

[b] Includes cucumbertree, elm, black gum, and black walnut.

Table 8.—Sawlog production and receipts in the SOUTHERN REGION of West Virginia, by species and destination of shipments, 1974

[In millions of board feet, International 1/4-inch rule]

Species	Cut and retained in region	Out-shipments		Total production	In-shipments		Total receipts
		To other regions	To other states		From other regions	From other states	
Hemlock	3.3	0.2	—	3.5	—	—	3.3
Yellow pines	2.8	(a)	0.3	3.1	—	—	2.8
Other pines	1.5	.1	—	1.6	—	—	1.5
Other softwoods	.3	(a)	—	.3	—	—	.3
Total softwoods	7.9	0.3	0.3	8.5	—	—	7.9
Ash	2.7	.1	—	2.8	(a)	(a)	2.7
Basswood	7.5	.4	—	7.9	(a)	(a)	7.5
Beech	9.9	.4	.4	10.7	(a)	(a)	9.9
Birch	1.4	.1	—	1.5	(a)	—	1.4
Black cherry	2.0	.2	—	2.2	(a)	—	2.0
Gum	2.7	(a)	—	2.7	(a)	—	2.7
Hickory	10.3	.6	.8	11.7	(a)	—	10.3
Red maple	6.9	.2	.1	7.2	(a)	(a)	6.9
Sugar maple	11.2	.6	.1	11.9	0.1	(a)	11.3
White oak	13.1	.5	.2	13.8	.1	(a)	13.2
Chestnut oak	16.2	.7	.7	17.6	.1	(a)	16.3
Northern red oak	32.1	1.0	1.0	34.1	.2	0.1	32.4
Other red oaks	20.3	1.1	1.1	22.5	.4	.1	20.8
Yellow-poplar	35.5	1.0	1.1	37.6	.4	.1	36.0
Other hardwoods[b]	6.3	.2	.2	6.7	.3	(a)	6.6
Total hardwoods	178.1	7.1	5.7	190.9	1.6	0.3	180.0
All species	186.0	7.4	6.0	199.4	1.6	0.3	187.9

[a] Less than 50,000 board feet.

[b] Includes cucumbertree, elm, and black walnut.

Table 9.—Sawlog production and receipts in the NORTHWESTERN REGION of West Virginia, by species and destination of shipments, 1974

[In millions of board feet, International 1/4-inch rule]

Species	Cut and retained in region	Out-shipments		Total production	In-shipments		Total receipts
		To other regions	To other states		From other regions	From other states	
Yellow pine	0.9	(a)	—	0.9	(a)	(a)	0.9
Other softwoods [b]	.3	0.1	—	.4	(a)	0.1	.4
Total softwoods	1.2	0.1	—	1.3	(a)	0.1	1.3
Ash	.7	.2	0.2	1.1	0.1	.1	.9
Basswood	.8	.4	.1	1.3	(a)	(a)	.8
Beech	2.1	.3	.2	2.6	.2	.1	2.4
Hickory	3.3	.5	.3	4.1	.5	.1	3.9
Red maple	.6	.5	.6	1.7	.1	(a)	.7
Sugar maple	1.4	.7	.5	2.6	.1	(a)	1.5
White oak	6.2	.7	1.8	8.7	.6	.1	6.9
Chestnut oak	5.5	1.0	.7	7.2	.7	.2	6.4
Northern red oak	14.1	1.7	2.2	18.0	.6	.4	15.1
Other red oak	11.1	1.1	1.3	13.5	1.1	.3	12.5
Black walnut	1.0	.1	.2	1.3	.1	.2	1.3
Yellow-poplar	7.0	2.3	1.7	11.0	.5	.3	7.8
Other hardwoods [c]	2.7	.9	.2	3.8	.4	(a)	3.1
Total hardwoods	56.5	10.4	10.0	76.9	5.0	1.8	63.3
All species	57.7	10.5	10.0	78.2	5.0	1.9	64.6

[a] Less than 50,000 board feet.

[b] Includes hemlock, white pine, and spruces.

[c] Includes birch, black cherry, cucumbertree, elm, and gum.

Table 10.—Pulpwood production in West Virginia by species groups, 1963-1974[a]

Year	All species	Softwoods	Hardwoods
1963	338.8	99.8	239.0
1964	398.2	109.6	288.6
2-year average	368.5	104.7	263.8
1965	411.7	102.6	309.1
1966	366.3	86.7	279.6
1967	450.7	96.7	354.0
1968	407.5	78.1	329.4
1969	429.1	88.3	340.8
5-year average	413.1	90.5	322.6
1970	385.1	73.3	311.8
1971	340.4	73.2	267.2
1972	335.3	74.6	260.7
1973	417.1	81.7	335.4
1974	412.1	54.5	357.6
5-year average	378.0	71.5	306.5

[a] Includes production from roundwood manufacturing residues.

Table 11.—Output of pulpwood from roundwood in West Virginia by species groups and geographic regions, 1965-1974

[In thousands of rough cords]

Species group and region	Roundwood pulpwood output in:										
	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	All years
Softwoods:											
Northeastern	68.4	57.2	64.5	46.0	49.8	40.4	41.8	44.5	40.0	28.6	481.2
Southern	7.3	5.5	6.8	6.5	8.9	8.9	6.4	5.4	16.9	5.7	78.3
Northwestern	26.6	21.8	21.3	18.9	19.9	19.0	20.9	20.3	17.3	16.5	202.5
All regions	102.3	84.5	92.6	71.4	78.6	68.3	69.1	70.2	74.2	50.8	762.0
Hardwoods:											
Northeastern	146.8	147.1	178.1	147.9	140.8	118.9	101.6	85.9	96.4	77.5	1,241.0
Southern	66.1	54.4	61.9	62.9	58.8	57.1	47.9	25.4	74.1	64.5	573.1
Northwestern	4.1	3.9	.7	5.9	1.5	11.5	9.6	8.8	13.5	20.8	80.3
All regions	217.0	205.4	240.7	216.7	201.1	187.5	159.1	120.1	184.0	162.8	1,894.4
All species	319.3	289.9	333.3	288.1	279.7	255.8	228.2	190.3	258.2	213.6	2,656.4

Table 12.—Veneer log production in West Virginia, by species and consuming state, 1974

[In thousands of board feet, International 1/4-inch rule]

Species	Cut and retained in West Virginia	Exported to:			Total production
		Pennsylvania	Virginia	Other states	
Basswood	—	—	6	—	6
Hickory	87	4	792	—	883
Maple	—	—	29	15	44
White oak	62	—	102	—	164
Red oak	275	254	119	—	648
Black walnut	62	—	—	132	194
Yellow-poplar	25	—	519	576	1,120
Other species	75	—	29	—	104
All species	586	258	1,596	723	3,163

Table 13.—Veneer log production, receipts, and interstate shipments in West Virginia for selected years

[In millions of board feet, International 1/4-inch rule]

Year	Production	Interstate shipments		Receipts
		Exports	Imports	
1963	7.0	4.5	3.8	6.3
1965	4.6	2.1	3.9	6.4
1968	7.9	5.1	5.9	8.7
1972	4.3	2.6	4.4	6.1
1974	3.2	2.6	3.7	4.3

Table 14.—Production and distribution of manufacturing residues, by type of uses, and industry source, West Virginia, 1974

[In thousands of cubic feet]

Source industry	Type of use	Type of residue			All types
		Bark	Coarse [a]	Fine [b]	
Lumber	Fiber	—	14,037	2,427	16,464
	Fuel [c]	2,995	1,086	2,461	6,542
	Agricultural [d]	104	—	793	897
	Other [e]	2,247	2,224	2,808	7,279
	All uses	5,346	17,347	8,489	31,182
	Unused	2,903	3,697	4,747	11,347
Veneer	Fiber	—	—	—	—
	Fuel	68	384	161	613
	Agricultural	—	—	—	—
	Other	—	—	—	—
	All uses	68	384	161	613
	Unused	10	12	5	27
Cooperage	Fiber	—	190	—	190
	Fuel	10	52	—	62
	Agricultural	—	—	9	9
	Other	38	21	38	97
	All uses	48	263	47	358
	Unused	13	43	7	63
Other industries	Fiber	—	218	—	218
	Fuel	—	233	—	233
	Agricultural	—	—	38	38
	Other	46	146	45	237
	All uses	46	597	83	726
	Unused	98	131	45	274
All industries [f]	Fiber	—	14,445	2,427	16,872
	Fuel	3,073	1,755	2,622	7,450
	Agricultural	104	—	840	944
	Other	2,331	2,391	2,891	7,613
	All uses	5,508	18,591	8,780	32,879
	Unused	3,024	3,883	4,804	11,711

[a] Includes slabs, edgings, trimmings, veneer cores, and other material suitable for chipping.

[b] Includes sawdust, shavings, and other material considered unsuitable for chipping.

[c] Includes both domestic and industrial fuel.

[d] Includes livestock bedding and farm and horticultural mulch.

[e] Includes small dimension, charcoal wood, and metallurgical chips.

[f] Excludes the woodpulp industry.

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1977. **The timber industries of West Virginia.**
Northeast. For. Exp. Stn., Upper Darby, Pa.
16 p., illus. (USDA For. Serv. Resour. Bull. NE-47)

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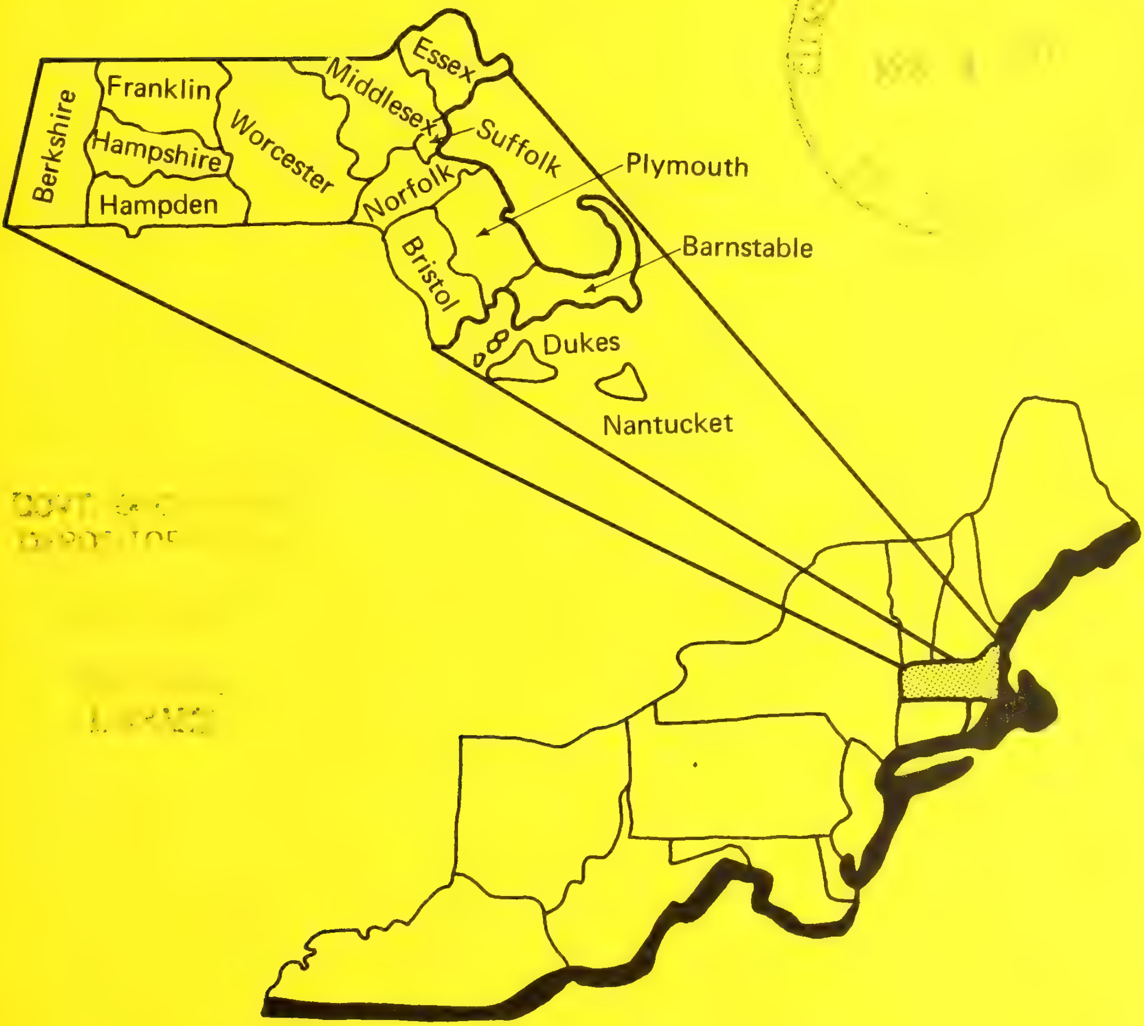

USDA FOREST SERVICE RESOURCE BULLETIN NE–48
1977
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NORTHEASTERN FOREST EXPERIMENT STATION
6816 MARKET STREET, UPPER DARBY, PA. 19082

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FOREST STATISTICS for MASSACHUSETTS

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Upper Darby, Pa., 19082

THE MASSACHUSETTS RESURVEY

THIS REPORT contains data from the second inventory of the forest resources of Massachusetts. The inventory was completed in 1971 by the Northeastern Forest Experiment Station in cooperation with the Massachusetts Department of Natural Resources.

The first inventory of Massachusetts was completed in 1952. Because of many differences in standards and measurement techniques, the results of the current inventory are not directly comparable to the initial inventory. The trends in the resource, after the initial data have been adjusted to the resurvey standards, show these changes:

	1953	*1972*	*Change*
COMMERCIAL FOREST LAND (thousand acres):	3,259.2	2,797.7	−461.5
GROWING STOCK VOLUME (million cubic feet):			
Softwoods	804.1	1,267.3	463.2
Hardwoods	1,311.2	2,215.6	814.4
Total	2,115.3	3,392.9	1,277.6
SAWTIMBER VOLUME (million board feet):			
Softwoods	1,905.0	3,535.2	1,630.2
Hardwoods	1,554.0	3,056.8	1,502.8
Total	3,459.0	6,592.0	3,133.0

The inventory statistics reported here were obtained by a sampling procedure that utilizes recent aerial photography, the partial remeasurement of ground samples from the initial inventory, and the establishment of new ground sample locations. In Massachusetts this required the remeasurement of 250 plots, the interpretation of 11,200 points on aerial photographs into land-use and cubic-foot volume classes, and the location and establishment of 329 on-the-ground measurement locations as a subsample of the photo points. The data thus collected were summarized according to the Sampling with Partial Replacement (SPR) design, using the FINSYS computer system developed by the Northeastern Forest Experiment Station.

The inventory was designed to estimate resource data for the State as a whole. However, estimates for individual counties are also available, based on the photo-plot data for the particular county, expanded by the on-the-ground measurement subsample for a photo unit. Since this procedure is based on the assumption that certain attributes of the ground plots are homogeneous across county boundaries, in Massachusetts every attempt has been made to develop photo units that are homogeneous for the attributes of interest. Nevertheless, the user of county data should recognize the limited and variable accuracy of the estimates for individual counties.

The reader may wish to consult other companion publications regarding this resurvey. THE

FOREST RESOURCES OF SOUTHERN NEW ENGLAND (Resource Bulletin NE−36, 1974, by Neal P. Kingsley) provides an analysis and interpretation of the current forest resource of this region along with an evaluation of the trends since the first inventory. PRIMARY WOOD-PRODUCT INDUSTRIES OF SOUTHERN NEW ENGLAND, 1971 (Resource Bulletin NE−30, 1973, by James T. Bones) is a report on a complete canvass of the primary wood manufacturers and an analysis of the trends in industrial wood output since 1952. THE FOREST-LAND OWNERS OF SOUTHERN NEW ENLAND (Resource Bulletin NE−41, 1976, by Neal P. Kingsley) is a report on a canvass of forest-land owners in the three Southern New England states, including an analysis of their ownership objectives, harvesting practices and socioeconomic characteristics.

THE FOREST RESOURCE

Of the total land area of Massachusetts, 56 percent—2,797,700 acres—is commercial forest land. This is a decrease of 14 percent since the last survey.[1]

The distribution of commercial forest land area by major forest type has changed significantly since the last survey. In softwood types, the area of the white pine-red pine-hemlock type has increased while the area of the pitch pine type has decreased. In hardwood types, the area of the elm-ash-red maple type has increased while the areas of all other hardwood types have decreased.

As part of the survey, a canvass was made of the attitudes and objectives of the owners of privately-owned commercial forest land. A detailed questionnaire was sent to all owners of forest survey plot locations that were classified as privately-owned. Data from the questionnaires reveal that there are more than 100,000 owners of commercial forest land in the State. Eighty-five percent of them are individuals, 8 percent are corporations, and the remaining 7 percent are partnerships, associations, undivided estates, and the like. Individuals hold 76 percent of the privately held commercial forest land, corporations 13 percent, and other owners 11 percent. The average owner of private commercial forest land in Massachusetts holds fewer than 25 acres. The study also shows that fewer than 1 of 7 owners in the State have harvested timber.

Despite the decrease in commercial forest land area, the current net volume of growing stock has increased substantially. Current total net volumes of 3,393 million cubic feet and 6,592 million board feet represent averages of 1,213 cubic feet and 2,356 board feet per acre of commercial forest land. These are increases of 60 percent in cubic-foot volume and 90 percent in board-foot volume between surveys.

The softwood and hardwood proportions of total net growing stock volume are nearly the same as in 1953. Softwoods equal 37 percent of the total cubic-foot volume and 54 percent of the total board-foot volume. White pine accounts for 71 percent of total softwood volume. Hemlock is next with 17 percent. In the hardwoods, the predominant species in cubic-foot volume are red maple (24 percent), northern red oak (19 percent), and other oaks, mostly white, black, and chestnut oak (21 percent). In board-foot volume, northern red oak is first (27 percent), followed by other oaks (25 percent) and red maple (15 percent).

Average annual growth-and-removal data show that, for all species combined, growth has exceeded removals by a ratio of more than 2 to 1 during the period between surveys. The corresponding ratio for softwood sawtimber is more than 3 to 1.

Among counties, the ratio of growing-stock volume per acre of commercial forest land varies only slightly. Berkshire County, with the highest ratio, contains 15 percent of the commercial forest land and 18 percent of the growing-stock volume in the State. At the other end of the scale, Barnstable County contains 2 percent of the commercial forest land and 2 percent of the growing-stock volume.

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[1] Ferguson, R. H., and J. J. McGuire, 1956. The timber resources of Massachusetts. USDA For. Serv. Northeast. For. Exp. Stn. 45 p.

DEFINITION OF TERMS

Land Area Classes

Land area.—(a) Bureau of the Census. The area of dry land and land that is temporarily or partly covered by water, such as marshes, swamps, and river flood plains; streams, sloughs, estuaries, and canals that are less than ⅛ statute mile in width; and lakes, reservoirs, and ponds that are less than 40 acres in area. (b) Forest Survey. The same as the Bureau of the Census, except that the minimum width of streams, etc. is 120 feet and the minimum size of lakes etc. is 1 acre.

Forest land.—Land that is at least 16.7 percent stocked (contains at least 7.5 square feet of basal area) by forest trees of any size, or that formerly had such tree cover and is not currently developed for nonforest use. (Forest trees are woody plants that have a well-developed stem and usually are more than 12 feet in height at maturity.) The minimum area for classification of forest land is 1 acre.

Commercial forest land.—Forest land that is producing or capable of producing crops of industrial wood (more than 20 cubic feet per acre per year) and is not withdrawn from timber utilization. (Industrial wood: all roundwood products, except fuelwood.)

Ownership Classes

Federal.—Lands (other than National Forests) that are administered by Federal agencies.

State.—Lands that are owned by the state or leased to a state for 50 years or more.

County and municipal.—Lands that are owned by counties and local public agencies or municipalities or leased to them for 50 years or more.

Forest industry.—Lands that are owned by companies or individuals operating wood-using plants.

Miscellaneous private.—Privately owned lands other than forest-industry and farmer-owned lands.

Farmer-owned.—Lands that are owned by farm operators, whether part of the farmstead or not. Excludes land leased by farm operators from non-farm owners.

Stand-Size Classes

Stand.—A growth of trees (see definitions under "Tree Classes") on a minimum of 1 acre of forest land that is at least 16.7 percent stocked by forest trees of any size.

Sawtimber stands.—Stands that are at least 16.7 percent stocked with growing-stock trees, with half or more of total stocking in sawtimber or poletimber trees, and with sawtimber stocking at least equal to poletimber stocking.

Poletimber stands.—Stands that are at least 16.7 percent stocked with growing-stock trees of which half or more of this stocking is in poletimber and/or sawtimber trees and in which poletimber stocking exceeds that of sawtimber.

Sapling-seedling stands.—Stands that are at least 16.7 percent stocked with growing-stock trees of which more than half of the stocking is sapling and/or seedlings.

Nonstocked areas.—Commercial forest land that is less than 16.7 percent stocked with growing-stock trees.

Tree Classes

Growing-stock trees.—Live trees of commercial species that are classified as sawtimber, poletimber, saplings, and seedlings; that is, all live trees of commercial species except rough and rotten trees.

Rotten trees.—Live trees of commercial species that do not contain at least one 12-foot sawlog or two nontiguous sawlogs, each 8 feet or longer, now or prospectively, and do not meet regional specifications for freedom from defect primarily because of rot; that is, when more than 50 percent of the cull volume in a tree is rotten.

Rough trees.—(a) The same as above, except that rough trees do not meet regional specifications for freedom from defect primarily because of roughness or poor form, and (b) all live trees that are of noncommercial species.

Forest Types

Forest type.—A classification of forest land based upon the species forming a plurality of basal area of live trees. The many local forest types in the Northeast were combined into the following major forest types:

White pine-red pine-hemlock.—Forests in which eastern white pine, red pine, or hemlock, singly or in combination, make up a plurality of the stocking. (Common associates include aspen, birch, and maple.)

Spruce-fir.—Forests in which spruce or true firs, singly or in combination, comprise a plurality of the stocking. (Common associates include white cedar, tamarack, maple, birch, and hemlock.)

Pitch pine-eastern redcedar.—Forests in which pitch pine or eastern redcedar, singly or in combination, make up a plurality of the stocking. (Common associates include oak and hickory.)

Oak-pine.—Forests in which oaks or hickory, singly or in combination, make up a plurality of the stocking, but in which pitch pine and/or eastern redcedar make up 25 to 50 percent of the stocking.

Oak-hickory.—Forests in which oaks or hickory, singly or in combination, make up a plurality of the stocking, except where pitch pine and/or eastern redcedar make up 25 or 50 percent, in which case the stand would be classified oak-pine. (Common associates include yellow-poplar, elm, and red maple.)

Elm-ash-red-maple.—Forests in which elm, ash, or red maple, singly or in combination, make up a plurality of the stocking. (Common associates include beech and sugar maple.)

Maple-beech-birch.—Forests in which sugar maple, beech, or yellow birch, singly or in combination, make up a plurality of the stocking. (Common associates include sweet birch, black cherry, hemlock, and white pine.)

Class of Timber

Sawtimber trees.—Live trees of commercial species, (a) that are of the following minimum diameters at breast height—softwoods 9.0 inches and hardwoods 11.0 inches, and (b) that contain at least one 12-foot or two noncontiguous 8-foot merchantable sawlogs and that meet regional specifications for freedom from defect.

Poletimber trees.—Live trees of commercial species that meet regional specifications of soundness and form, and are at least 5.0 inches dbh but are smaller than sawtimber size.

Saplings.—Live trees of commercial species that are 1.0 to 5.0 inches dbh and of good form and vigor.

Seedlings.—Live trees of commercial species that are less than 1.0 inch dbh and are expected to survive.

Timber Measurement and Volume

Growing-stock volume.—Net volume, in cubic feet, of live growing-stock trees that are 5.0 inches dbh and larger, from a 1-foot stump to a minimum 4.0-inch top diameter outside bark of the central stem, or to the point where the central stem breaks into limbs. Net volume equals gross volume less deduction for rot and/or sweep and crook.

Sawtimber volume.—Net volume in board feet, International ¼-inch rule, of merchantable sawlogs in live sawtimber trees. Net volume equals gross volume less deductions for rot, sweep, and other defects that affect use for lumber.

Annual Net Growth and Timber Removals

Average annual net growth of growing stock.—The change (resulting from natural causes) in volume of sound wood in sawtimber and poletimber trees during the period between surveys, divided by the length of the period. (Components of annual net growth of growing stock include the increment in net volume of trees present at the beginning of the period and surviving to its end, plus net volume of trees reaching poletimber size during the period, minus the net volume of trees that died during the period, minus the net volume of trees that became rough or rotten trees during the period, cull increment.)

Average annual growing-stock removals.—The net cubic-foot volume of growing-stock trees removed by harvesting or killed in logging, cultural operations such as timber-stand improvement, and land-clearing; or changes in land use during the period between surveys, converted to an annual basis.

Average annual net growth of sawtimber—The change (resulting from natural causes) in net board-foot volume of sawtimber during the period between surveys, divided by the length of the period. (Components of annual net growth of sawtimber include the increment in net volume of sawtimber trees present at the beginning of the period and surviving to its end, plus the net volume of trees reaching sawtimber size during the period, minus the net volume of sawtimber trees that died during the period, minus the net volume of sawtimber trees that became rough or rotten trees during the period between surveys, cull increment.)

Average annual sawtimber removals.—The net board-foot volume of sawtimber trees removed by harvesting or killed in logging, cultural operations such as timber-stand improvement, and land-clearing; or changes in land use during the period between surveys, converted to an annual basis.

Annual removals trend-level.—The estimated removals of growing stock or sawtimber for a specific year that are consistent with the trend of removals during the period between surveys and with the current inventory.

Logging residues.—The unused growing-stock volume of trees cut for products and the total growing-stock volume of trees destroyed in the course of logging but not removed for products.

Other removals.—The growing-stock volume of trees that were removed from the inventory and not used for products, in cultural operations (weeding, thinning, etc.), land-clearing, and reclassification of some commercial forest land as noncommercial forest land.

Plant byproducts.—Wood products such as slabs, edgings, and veneer cores that are obtained incidental to the production of timber products and are utilized in the manufacture of other timber products. (Bark is not included.)

Plant residues.—Wood material produced incidental to the production of timber products but not utilized.

Roundwood products.—Logs, bolts, or other round sections cut from growing stock or nongrowing stock for industrial or nonindustrial uses.

Timber products.—Roundwood products and plant byproducts from all sources.

Timber removals.—The growing-stock volume of trees removed from the inventory for roundwood products, plus logging residues and other removals.

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Table 1.--Area by land classes, Massachusetts, 1972

Land class	Area	
	Thousand acres	Percent
Forest land:		
Commercial	2,797.7	56
Productive-reserved	104.5	2
Unproductive	50.1	1
Total forest land	2,952.3	59
Nonforest:		
Cropland [a]	247.5	5
Pasture [a]	53.1	1
Other	1,760.2	35
Total nonforest land	2,060.8	41
Total area[c]	5,013.1	100

[a] Source: 1969 and 1964 Census of Agriculture. Total cropland includes cropland used for pasture. Pasture total based upon ratios developed from the 1964 Census report. Data extrapolated to 1972.

[b] Includes swampland, industrial and urban areas, other nonforest land, and 43,700 acres classed as water by Forest Survey standards, but defined by the Bureau of the Census as land.

[c] Source: United States Bureau of the Census, Areas of Massachusetts, 1960 (April 1967).

Table 2.--Area of commercial forest land, by ownership classes, Massachusetts, 1972

Ownership class	Area[a]	
	Thousand acres	Percent
Other Federal	9.6	b/
State	240.1	9
County and municipal	115.7	4
Total public	365.4	13
Forest industry	30.1	1
Farmer-owned	253.6	9
Miscellaneous private:		
Individual c/	1,918.3	69
Corporate	230.3	8
Total private	2,432.3	87
All ownerships	2,797.7	100

a/ Estimates of area in each private ownership class are based upon the forest-land ownership study by the Northeastern Forest Experiment Station. Public ownerships are from ownership records.

b/ Less than 0.5 percent.

c/ Includes acreage owned by business partnerships and organizations such as churches, Boy Scouts of America, and associations.

Table 3.--Area of commercial forest land, by ownership, stand-size, and stand-volume classes, Massachusetts, 1972

(In thousands of acres)

Stand-size and stand-volume class	All ownerships	Other public	Forest industry	Farmer and other
	BY STAND-SIZE CLASSES			
Sawtimber stands	934.1	138.1	--	796.0
Poletimber stands	947.2	113.0	30.1	804.1
Sapling-seedling stands	857.5	102.5	--	755.0
Nonstocked areas	58.9	11.8	--	47.1
All classes	2,797.7	365.4	30.1	2,402.2
	BY STAND-VOLUME PER ACRE CLASSES[a/]			
Less than 1,500	1,132.6	148.5	--	984.1
15,00 to 5,000	1,274.7	146.9	30.1	1,097.7
More than 5,000	390.4	70.0	--	320.4
All classes	2,797.7	365.4	30.1	2,402.2

a/ In board feet, International 1/4-inch rule.

Table 4.--Area of commercial forest land, by stocking classes based on selected stand components, Massachusetts, 1972

(In thousands of acres)

Stocking class [a] (percent)	Stocking classified in terms of--				
	All trees	Growing-stock trees			Rough and rotten trees
		Total	Desirable	Acceptable	
Overstocked:					
160	14.1	--	--	--	--
150 to 160	173.9	57.1	--	28.2	--
140 to 150	229.7	58.4	--	59.0	--
130 to 140	551.6	85.2	--	71.3	15.2
Total	969.3	200.7	--	158.5	15.2
Fully stocked:					
120 to 130	585.9	418.0	--	261.0	--
110 to 120	430.0	359.2	--	301.5	--
100 to 110	299.9	386.4	--	429.3	--
Total	1,315.8	1,163.6	--	991.8	--
Medium stocked:					
90 to 100	207.2	326.5	--	440.4	--
80 to 90	158.3	408.0	--	349.7	29.1
70 to 80	73.0	170.8	--	286.8	42.8
60 to 70	14.9	157.4	--	185.3	72.5
Total	453.4	1,062.7	--	1,262.2	144.4
Poorly stocked:					
50 to 60	14.0	131.4	--	103.8	102.2
40 to 50	--	75.3	42.4	117.4	268.2
30 to 40	--	30.3	29.1	30.3	317.0
20 to 30	30.3	30.3	70.5	30.3	527.7
10 to 20	14.9	103.4	443.3	103.4	736.1
Less than 10	--	--	2,212.4	--	686.9
Total	59.2	370.7	2,797.7	385.2	2,638.1
All classes	2,797.7	2,797.7	2,797.7	2,797.7	2,797.7

[a] Fully stocked stands are considered to contain 75 to 100 square feet of basal area per acre.

Table 5.--Area of commercial forest land, by ownership, potential site productivity, and area-condition classes, Massachusetts, 1972

(In thousands of acres)

Growth-per-acre and area-condition class	All ownerships	Other public	Forest industry	Farmer and other
	BY GROWTH-PER-ACRE CLASSES[a]			
120 to 165	172.8	34.1	--	138.7
85 to 120	587.2	80.0	--	507.2
50 to 85	862.0	115.1	--	746.9
Less than 50	1,175.7	136.2	30.1	1,009.4
All classes	2,797.7	365.4	30.1	2,402.2
	BY AREA-CONDITION CLASSES[b]			
Class 10-40	--	--	--	--
Class 50	1,135.2	182.8	30.1	922.3
Class 60	1,262.2	113.2	--	1,149.0
Class 70	400.3	69.4	--	330.9
All classes	2,797.7	365.4	30.1	2,402.2

[a] In cubic feet.

[b] Class 10-40.--Areas medium to fully stocked with desirable trees.

Class 50.--Areas poorly stocked with desirable trees but fully stocked with growing-stock trees.

Class 60.--Areas poorly stocked with desirable trees, but with medium to full stocking of growing-stock trees.

Class 70.--Areas poorly stocked with desirable trees, and poorly stocked with growing-stock trees.

Table 6.--Area of commercial forest land, by forest types, ownership classes, and stand-size classes, Massachusetts, 1972

(In thousands of acres)

Ownership and stand-size classes	White pine-red pine-hemlock	Spruce-fir	Pitch pine	Oak-pine	Oak-hickory	Elm-ash-red maple	Maple-beech-birch	Aspen-birch	Total
BY OWNERSHIP CLASSES									
Other public	79.0	11.2	23.7	23.4	56.5	126.6	22.6	22.4	365.4
Forest industry	--	--	--	30.1	--	--	--	--	30.1
Farmer and other	553.2	17.4	50.2	164.1	545.8	668.7	353.4	49.4	2,402.2
All ownerships	632.2	28.6	73.9	217.6	602.3	795.3	376.0	71.8	2,797.7
BY STAND-SIZE CLASSES									
Sawtimber stands	389.0	28.6	29.1	71.7	155.7	115.3	144.7	--	934.1
Poletimber stands	114.8	--	--	85.9	271.3	317.1	129.6	28.5	947.2
Sapling-seedling stands	128.4	--	30.0	60.0	175.3	348.0	87.7	28.1	857.5
Nonstocked areas	--	--	14.8	--	--	14.9	14.0	15.2	58.9
All stands	632.2	28.6	73.9	217.6	602.3	795.3	376.0	71.8	2,797.7

Table 7.--Area of commercial forest land by local forest types and major forest types, Massachusetts, 1972

(In thousands of acres)

Forest type	Area	
	Local	Major
White pine-red pine-hemlock:		
Red pine	14.7	
White pine	401.4	
White pine-hemlock	144.3	
Hemlock	71.8	
Total		632.2
Spruce-Fir:		
Tamarack	14.5	
Norway spruce plantation	14.1	
Total		28.6
Pitch pine:		
Pitch pine	73.9	
Total		73.9
Oak-pine:		
White pine-N. red oak-white ash	114.6	
Eastern redcedar-hardwoods	14.1	
Other oak-pines	88.9	
Total		217.6
Oak-hickory:		
Post, black, or bear oak	127.8	
White oak-red oak-hickory	57.4	
White oak	42.8	
Northern red oak	287.7	
Mixed hardwoods	86.6	
Total		602.3
Elm-ash-red maple:		
Black ash-elm-red maple	795.3	
Total		795.3
Maple-beech-birch:		
Sugar maple-beech-yellow birch	315.1	
Black cherry	60.9	
Total		376.0
Aspen-birch:		
Aspen	57.8	
Paper birch	14.0	
Total		71.8
All forest types	2,797.7	2,797.7

Table 8.--Area of noncommercial forest land, by forest types, Massachusetts, 1972

(In thousands of acres)

Forest type	All areas	Productive-reserved areas	Unproductive areas
White pine-red pine-hemlock	37.1	22.6	14.5
Spruce-fir	3.2	3.2	--
Pitch pine	6.8	6.8	--
Oak-pine	6.7	6.7	--
Oak-hickory	20.2	16.2	4.0
Elm-ash-red maple	67.8	36.2	31.6
Maple-beech-birch	6.4	6.4	--
Aspen-birch	6.4	6.4	--
All types	154.6	104.5	50.1

Table 9.--Number of trees on commercial forest land by species groups, tree classes, and diameter classes, Massachusetts, 1972

(In thousands of trees)

Dbh class (inches)	Softwoods			Hardwoods		
	Growing-stock trees	Rough and rotten trees	Total	Growing-stock trees	Rough and rotten trees	Total
Saplings:						
1.0 to 2.9	116,214	37,475	153,689	358,577	388,675	747,252
3.0 to 4.9	60,745	18,765	79,510	220,439	100,550	320,989
Total	176,959	56,240	233,199	579,016	489,225	1,068,241
Poletimber:						
5.0 to 6.9	49,059	7,036	56,095	141,057	32,657	173,714
7.0 to 8.9	31,377	3,922	35,299	81,824	14,030	95,854
9.0 to 10.9	--	--	--	43,078	6,077	49,155
Total	80,436	10,958	91,394	265,959	52,764	318,723
Small sawtimber:						
9.0 to 10.9	21,650	2,031	23,681	--	--	--
11.0 to 12.9	13,426	1,023	14,449	20,804	3,834	24,638
13.0 to 14.9	7,142	435	7,577	9,359	1,316	10,675
Total	42,218	3,489	45,707	30,163	5,150	35,313
Large Sawtimber:						
15.0 to 16.9	3,804	387	4,191	3,999	568	4,567
17.0 to 18.9	2,471	32	2,503	1,991	764	2,755
19.0 to 20.9	976	150	1,126	924	213	1,137
21.0 to 28.9	765	145	910	921	454	1,375
29.0 and larger	49	131	180	89	40	129
Total	8,065	845	8,910	7,924	2,039	9,963
All classes	307,678	71,532	379,210	883,062	549,178	1,432,240

Table 10.--Number of growing-stock trees on commercial forest land, by species and diameter classes, Massachusetts, 1972

(In thousands of trees)

Species	All classes	Diameter class (inches at breast height)									
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
White pine	73,784	23,171	17,756	12,524	8,419	4,895	3,246	2,127	898	699	49
Pitch pine	10,338	4,255	2,705	1,783	969	398	166	62	--	--	--
Hemlock	32,679	16,045	7,468	4,573	3,052	902	276	219	78	66	--
Other softwoods	13,918	5,588	3,448	2,770	986	947	116	63	--	--	--
Total softwoods	130,719	49,059	31,377	21,650	13,426	7,142	3,804	2,471	976	765	49
Select white oaks	22,500	10,384	6,746	2,552	1,575	632	252	155	71	122	11
Select red oaks	42,379	12,521	12,176	8,642	4,514	1,887	1,290	708	351	230	60
Other red oaks a/	34,340	12,317	9,108	6,126	3,730	1,708	669	409	149	113	11
Hickory	6,865	2,695	1,623	1,428	494	405	78	95	25	22	--
Sugar maple	20,616	9,330	5,568	2,858	1,094	893	429	188	100	156	--
Soft maples	91,686	47,538	26,650	10,568	4,396	1,573	646	92	151	65	7
Sweet birch	11,021	5,394	3,001	1,704	508	282	79	33	--	20	--
Yellow birch	10,123	4,703	3,323	1,264	423	307	--	61	25	17	--
Paper birch	15,201	8,665	2,724	2,615	822	276	72	--	27	--	--
Beech	8,208	3,165	2,002	1,348	986	372	236	61	--	38	--
White ash	10,845	6,027	2,166	982	1,001	429	42	97	25	76	--
Black cherry	15,393	9,699	3,097	1,664	505	375	--	34	--	19	--
Aspen	7,671	4,146	2,288	570	408	107	122	30	--	--	--
Elms	2,303	1,079	677	344	68	113	--	--	--	22	--
Other hardwoods	4,895	3,394	675	413	280	--	84	28	--	21	--
Total hardwoods	304,046	141,057	81,824	43,078	20,804	9,359	3,999	1,991	924	921	89
All species	434,765	190,116	113,201	64,728	34,230	16,501	7,803	4,462	1,900	1,686	138

a/ Includes 42,000 other white oaks.

Table 11.--Net volume of timber on commercial forest land, by class of timber, softwoods and hardwoods, Massachusetts, 1972

(In millions of cubic feet)

Class of timber	All species	Softwoods	Hardwoods
Sawtimber trees:			
Sawlog portion	1,402.0	781.7	620.3
Upper-stem portion	261.7	101.0	160.7
All sawtimber trees	1,663.7	882.7	781.0
Poletimber trees	1,729.2	384.6	1,344.6
All growing-stock trees	3,392.9	1,267.3	2,125.6
Rough trees	421.5	129.9	291.6
Rotten trees	88.4	8.6	79.8
Total, all trees	3,902.8	1,405.8	2,497.0

Table 12.--Net volume of growing stock and sawtimber on commercial forest land, by ownrship classes, stand-size classes, and forest types, softwoods and hardwoods, Massachusetts, 1972

Ownership, stand size, and forest type	Growing stock (million cubic feet)			Sawtimber (million board feet)[a]		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
BY OWNERSHIP CLASSES						
Other public	514.3	231.6	282.7	1,012.4	661.0	351.4
Forest industry	58.5	21.1	37.4	96.4	71.7	24.7
Farmer and other	2,820.1	1,014.6	1,805.5	5,483.2	2,802.5	2,680.7
All ownership	3,392.9	1,267.3	2,125.6	6,592.0	3,535.2	3,056.8
BY STAND-SIZE CLASSES						
Sawtimber stands	1,635.8	827.7	808.1	4,243.9	2,528.0	1,715.9
Poletimber stands	1,334.4	289.4	1,045.0	1,660.2	608.5	1,051.7
Sapling-seedling stands	417.6	149.1	268.5	678.7	398.7	280.0
Nonstocked areas	5.1	1.1	4.0	9.2	--	9.2
All classes	3,392.9	1,267.3	2,125.6	6,592.0	3,535.2	3,056.8
BY FOREST TYPES						
White pine-red pine-hemlock	1,064.2	768.5	295.7	2,572.9	2,171.6	401.3
Spruce-fir	49.0	42.2	6.8	110.3	98.2	12.1
Pitch pine	59.4	55.3	4.1	172.3	164.1	8.2
Oak-pine	264.2	105.3	158.9	531.8	268.0	263.8
Oak-hickory	677.3	57.4	619.9	1,091.4	161.1	930.3
Elm-ash-red maple	748.8	162.7	586.1	1,203.6	447.1	756.5
Maple-beech-birch	476.4	67.5	408.9	852.2	201.5	650.7
Aspen-birch	53.6	8.4	45.2	57.5	23.6	33.9
All types	3,392.9	1,267.3	2,125.6	6,592.0	3,535.2	3,056.8

Table 13.--Net volume of growing stock on commercial forest land, by species and diameter classes, Massachusetts, 1972

(In millions of cubic feet)

Species	All classes	Diameter class (inches at breast height)									
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
White pine	877.2	110.7	122.4	131.7	130.6	108.3	96.7	81.4	44.2	45.5	5.7
Pitch pine	68.1	6.4	12.8	15.7	14.1	10.6	5.7	2.8	--	--	--
Hemlock	215.9	56.3	40.6	38.5	39.4	17.3	7.7	8.2	3.7	4.2	--
Other softwoods	106.1	18.3	17.1	26.2	15.5	22.3	4.0	2.7	--	--	--
Total softwoods	1,267.3	191.7	192.9	212.1	199.6	158.5	114.1	95.1	47.9	49.7	5.7
Select white oaks	142.0	29.0	35.1	22.2	21.6	12.3	6.2	5.4	3.2	6.0	1.0
Select red oaks	404.3	42.3	72.2	82.8	69.3	40.7	36.5	26.7	15.4	13.1	5.3
Other red oaks a/	290.3	38.0	55.6	58.5	55.2	36.2	18.8	14.5	6.6	6.0	.9
Hickory	60.7	11.5	10.5	14.2	7.5	9.0	2.4	3.5	1.0	1.1	--
Sugar maple	171.3	39.4	37.1	28.4	17.1	18.6	11.8	6.4	4.2	8.3	--
Soft maples	522.2	157.0	150.7	94.4	58.8	30.4	16.6	3.1	6.2	4.1	.9
Sweet birch	66.6	17.2	17.3	15.7	6.9	5.2	2.2	1.1	--	1.0	--
Yellow birch	59.1	14.0	17.7	11.1	5.9	6.2	--	2.3	.9	1.0	--
Paper birch	84.6	25.6	14.8	24.0	11.8	5.3	2.1	--	1.0	--	--
Beech	75.8	11.0	13.1	14.9	16.3	8.3	7.4	2.5	--	2.3	--
White ash	80.3	21.1	13.9	9.8	15.1	9.0	1.2	3.6	1.3	5.3	--
Black cherry	81.5	31.5	17.7	15.5	7.2	7.4	--	1.1	--	1.1	--
Aspen	46.3	13.9	14.2	4.9	6.6	2.2	3.4	1.1	--	--	--
Elms	14.0	3.4	3.1	2.5	1.1	2.1	--	--	--	1.8	--
Other hardwoods	26.6	9.8	3.8	4.2	4.1	--	2.2	1.4	--	1.1	--
Total hardwoods	2,125.6	464.7	476.8	403.1	304.5	192.9	110.8	72.7	39.8	52.2	8.1
All species	3,392.9	656.4	669.7	615.2	504.1	351.4	224.9	167.8	87.7	101.9	13.8

a/ Includes 1,100,000 cubic feet of other white oaks.

Table 14.--Net volume of sawtimber on commercial forest land, by species and diameter classes, Massachusetts, 1972

(In millions of board feet)[a]

Species	All classes	Diameter class (inches at breast height)						
		9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
White pine	2,623.6	409.7	509.1	451.5	417.7	374.5	205.6	225.8	29.7
Pitch pine	186.2	48.7	53.8	45.0	25.6	13.1	--	--	--
Hemlock	456.4	120.2	155.8	72.5	33.1	37.7	17.3	19.8	--
Other softwoods	269.0	83.1	61.8	94.8	17.4	11.9	--	--	--
Total softwoods	3,535.2	661.7	780.5	663.8	493.8	437.2	222.9	245.6	29.7
Select white oaks	218.5	--	77.8	47.8	25.4	22.4	13.8	27.2	4.1
Select red oaks	820.2	--	249.4	158.5	149.6	113.0	65.9	59.7	24.1
Other red oaks [b]	538.9	--	198.3	141.5	77.4	60.6	29.6	27.7	3.8
Hickory	97.1	--	26.9	35.5	10.0	14.6	5.0	5.1	--
Sugar maple	265.0	--	61.1	72.3	48.7	26.9	18.6	37.4	--
Soft maples	464.6	--	210.0	118.6	69.5	13.1	29.1	19.4	4.9
Sweet birch	62.0	--	24.4	19.9	8.7	4.7	--	4.3	--
Yellow birch	63.5	--	21.1	24.2	--	9.4	4.5	4.3	--
Paper birch	75.9	--	41.9	20.5	8.7	--	4.8	--	--
Beech	143.8	--	58.8	32.5	30.9	10.7	--	10.9	--
White ash	137.6	--	54.6	35.0	4.9	14.8	5.0	23.3	--
Black cherry	63.7	--	25.5	28.9	--	4.7	--	4.6	--
Aspen	51.4	--	24.0	8.6	14.0	4.8	--	--	--
Elms	19.5	--	4.0	8.1	--	--	--	7.4	--
Other hardwoods	35.1	--	15.0	--	9.1	5.9	--	5.1	--
Total hardwoods	3,056.8	--	1,092.8	751.9	456.9	305.6	176.3	236.4	36.9
All species	6,592.0	661.7	1,873.3	1,415.7	950.7	742.8	399.2	482.0	66.6

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[a] International 1/4-inch rule

[b] Includes 4,400,000 board feet of other [illegible]

Table 15.--Net volume of sawtimber on commercial forest land, by species and quality classes, Massachusetts, 1972

(In millions of board feet)[a]

Species	All classes	Standard-lumber logs			
		Grade 1	Grade 2	Grade 3	Grade 4[b]
Softwoods:					
White pine	2,623.6	76.0	352.5	1,296.0	899.1
Red pine	51.3	16.1	7.6	22.4	5.2
Pitch pines	186.2	15.0	18.9	152.3	--
Other softwoods[c]	674.1	--	--	--	--
Total softwoods	3,535.2	107.1	379.0	1,470.7	904.3
Hardwoods:					
Select white oaks	218.5	14.0	29.3	131.1	44.1
Select red oaks	820.2	89.1	178.4	449.2	103.5
Other red oaks	538.9	34.4	70.4	344.8	89.3
Hickory	97.1	--	5.0	54.7	37.4
Yellow birch	63.5	3.6	9.2	27.8	22.9
Sweet birch	62.0	3.5	4.2	29.3	25.0
Paper birch	75.9	5.2	22.5	41.2	7.0
Sugar maple	265.0	10.4	28.0	171.3	55.3
Soft maples	464.6	2.9	30.8	314.0	116.9
Beech	143.8	1.4	--	126.7	15.7
White ash	137.6	15.4	37.0	65.7	19.5
Aspen	51.4	5.5	10.7	27.6	7.6
Black cherry	63.7	--	6.5	45.5	11.7
Elm	19.5	--	4.9	12.9	1.7
Other hardwoods	35.1	3.6	3.3	21.2	7.0
Total hardwoods	3,056.8	189.0	440.2	1,863.0	564.6
			(In percent)		
Hardwood quality	100	6	15	61	18

[a] International 1/4-inch rule.

[b] Grade 4 applies only to the pines. For hardwoods the volumes in this column are for construction logs.

[c] Species other than pine are not graded into standard-lumber grades.

Table 16.--Annual net growth, removals,[a] and mortality of growing stock and sawtimber on commercial forest land, by species, Massachusetts, 1971

Species	Growing stock			Sawtimber		
	Annual net growth	Annual timber removals	Annual mortality	Annual net growth	Annual timber removals	Annual mortality
	- - - Thousand cubic feet - - - -			- - - -Thousand board feet[b] - - - -		
Softwoods:						
White and red pines	34,051	9,329	3,057	113,256	22,789	7,931
Pitch pine	956	148	434	3,749	126	411
Hemlock	11,713	4,074	1,022	25,839	8,381	1,945
Spruce	2,132	366	549	5,114	594	594
Other softwoods	248	83	338	1,042	110	119
Total softwoods	49,100	14,000	5,400	149,000	32,000	11,000
Hardwoods:						
Select white oaks	6,203	1,443	378	11,702	2,936	163
Select red oaks	20,666	6,034	1,474	47,360	13,046	463
Other oaks	15,115	4,616	976	31,304	8,844	224
Hickory	1,303	174	--	3,743	584	--
Sugar maple	2,352	354	781	8,814	1,660	828
Soft maples	21,531	5,503	2,174	26,285	7,291	1,375
Sweet birch	2,369	390	173	3,212	854	--
Yellow birch	2,698	634	458	3,622	1,046	--
Paper birch	1,720	157	876	3,122	536	251
Beech	1,999	160	458	5,221	493	607
White ash	2,752	367	423	6,342	1,418	--
Black cherry	1,512	240	225	3,634	1,080	--
Aspen	1,691	426	705	2,930	866	--
Other hardwoods	-911	202	2,299	-1,291	346	2,089
Total hardwoods	81,000	20,700	11,400	156,000	41,000	6,000
Total, all species	130,100	34,700	16,800	305,000	73,000	17,000

Table 17.--Annual net growth and removals of growing stock and sawtimber on commercial forest land, by ownership classes, softwoods and hardwoods, Massachusetts, 1971

Ownership	Annual net growth			Annual timber removals		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
			GROWING STOCK			
			Thousand cubic feet			
Public	25,612	9,305	16,307	3,600	1,163	2,437
Forest industry	2,242	818	1,424	--	--	--
Farmer and other	102,246	38,977	63,269	31,100	12,837	18,263
All ownerships	130,100	49,100	81,000	34,700	14,000	20,700
			SAWTIMBER			
			Thousand board feet[a]			
Public	59,255	30,092	29,163	5,240	2,921	2,319
Forest industry	4,282	3,022	1,260	--	--	--
Farmer and other	241,463	115,886	125,577	67,760	29,079	38,681
All ownerships	305,000	149,000	156,000	73,000	32,000	41,000

a/ International 1/4-inch rule.

Table 18.--Annual mortality of growing stock and sawtimber on commercial forest land, by ownership classes, causes, softwoods and hardwoods, Massachusetts, 1971

Ownership and cause	Growing stock (thousand cubic feet)			Sawtimber (thousand board feet)[a]		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
BY OWNERSHIP CLASS						
Public	2,178	971	1,207	1,353	575	778
Forest industry	200	--	200	--	--	--
Farmer and other	14,422	4,429	9,993	15,647	10,425	5,222
All ownerships	16,800	5,400	11,400	17,000	11,000	6,000
BY CAUSE						
Disease	12,556	3,549	9,007	10,981	6,432	4,549
Weather	1,701	1,137	564	4,972	4,338	634
Fire	381	220	161	230	230	--
Suppression	198	--	198	--	--	--
Insects	32	32	--	--	--	--
Unknown	1,932	462	1,470	817	--	817
All causes	16,800	5,400	11,400	17,000	11,000	6,000

[a] International 1/4-inch rule.

Table 19.--Components of average annual net growth of growing stock and sawtimber on commercial forest land, softwoods and hardwoods, Massachusetts, 1952-71

Components	All species	Softwoods	Hardwoods
		GROWING STOCK Thousand cubic feet	
Growth on initial growing-stock inventory [a]	60,911	22,620	38,291
Ingrowth--saplings that became poletimber	72,378	23,544	48,834
Gross growth	133,289	46,164	87,125
Cull increment	8,989	764	8,225
Annual mortality	13,900	4,500	9,400
Average annual net growth	110,400	40,900	69,500
		SAWTIMBER Thousand board feet [b]	
Growth on initial sawtimber inventory [a]	101,965	58,425	43,540
Ingrowth--poletimber trees that became sawtimber	173,634	71,409	102,225
Gross growth	275,599	129,834	145,765
Cull increment	12,699	1,034	11,665
Annual mortality	13,500	8,800	4,700
Average annual net growth	249,400	120,000	129,400

[a] Including growth on trees that were cut.

[b] International 1/4-inch rule.

Table 20.--Sampling errors for major forest area and timber-volume classes, Massachusetts, 1972

Table no.	Item classification	Sampling error
	FOREST AREA	
		Percent
1	Forest-land area:	
	Commercial	2.0
	Unproductive	*
	Total	2.1
2	Ownership:	
	Forest industry	**
	Farmer owned	26
	Misc. private	4
	Farmer and misc. private	4
3	Stand-size class:	
	Sawtimber stands	10
	Poletimber stands	10
	Sapling-seedling stands	10
	Nonstocked areas	47
3	Stand-volume per acre (board feet):	
	Less than 1,500	8
	1,500 to 5,000	8
	More than 5,000	17
5	Growth-per-acre class (cubic feet):	
	120 to 165	28
	85 to 120	14
	50 to 85	11
	Less than 50	9
5	Area-condition class:	
	Class 50	9
	Class 60	8
	Class 70	16

Table no.	Item classification	Sampling error	
	TIMBER VOLUME		
		Cubic feet	Board feet
		Percent	
11	Class of timber:		
	Sawtimber trees	5	--
	Poletimber trees	4	--
	All growing stock	2.5	--
	Rough trees	9	--
	Rotten trees	12	--
	All live trees	2	--
12	Ownership:		
	Other public	19	24
	Forest industry	*	*
	Farmer and other	5	7
12	Stand-size class:		
	Sawtimber stands	9	7
	Poletimber stands	11	14
	Sapling-seedling	15	20
	Nonstocked areas	*	**
12	Forest type:		
	White pine-red pine-hemlock	12	13
	Spruce-fir	*	*
	Pitch pine	*	*
	Oak-pine	28	33
	Oak-hickory	15	19
	Elm-ash-red maple	15	20
	Maple-beech-birch	19	20
	Aspen-birch	*	*

		Cubic feet	Board feet
6	Forest type:		
	White pine-red pine-hemlock		12
	Spruce-fir		*
	Pitch pine		43
	Oak-pine		25
	Oak-hickory		13
	Elm-ash-red maple		12
	Maple-beech-birch		17
	Aspen-birch		44
		Percent	
13-14	Species:		
	White pine	10	9
	Pitch pine	34	40
	Hemlock	21	23
	Other softwoods	38	47
	All softwoods	8	7
	Select white oaks	14	20
	Select red oaks	12	15
	Other oaks	16	18
	Hickory	27	39
	Sugar maple	19	24
	Soft maple	10	17
	Sweet birch	24	32
	Yellow birch	24	34
	Paper birch	19	32
	Beech	23	32
	White ash	22	34
	Black cherry	27	38
	Aspen	26	42
	Elm	33	*
	Other hardwoods	31	*
	All hardwoods	5	8
	All species	2.5	3.6
13-14	Diameter classes (inches):		
	5.0- 6.9	6	--
	7.0- 8.9	5	--
	9.0-10.9 a/	5	11
	11.0-12.9	6	7
	13.0-14.9	9	8
	15.0-16.9	9	8
	17.0-18.9	10	10
	19.0-20.9	12	12
	21.0-28.9	13	13
	29.0 and larger	33	33
17	Growth by:		
	Softwoods	11	11
	Hardwoods	8	10
	All species	6	8
17	Removals by:		
	Softwoods	32	40
	Hardwoods	24	33
	All species	20	28
	MORTALITY		
18	By species group:		
	Softwoods	24	35
	Hardwoods	16	31
	All species	14	25
18	By cause:		
	Fire	*	**
	Disease	16	32
	Insects	**	--
	Weather	45	*
	Suppression	*	--
	Unknown	28	47

* Sampling errors of 50 to 99 percent.

** Sampling error of 100 percent or more.

a/Board-foot sampling error for this class is for softwoods only.

Table 21.--Output of timber products, by source of material, softwoods and hardwoods, Massachusetts, 1971

Product and species group	Standard units	Total output		Output from roundwood		Output from plant byproducts	
		Number of units	Thousand cubic feet	Number of units	Thousand cubic feet	Number of units	Thousand cubic feet
Sawlogs:							
Softwood	M bd. ft.[a]	42,003	7,038	42,003	7,038	--	--
Hardwood	M bd. ft.[a]	31,562	5,295	31,562	5,295	--	--
Total	M bd. ft.[a]	73,565	12,333	73,565	12,333	--	--
Veneer logs and bolts:							
Softwood	M bd. ft.[a]	--	--	--	--	--	--
Hardwood	M bd. ft.[a]	232	38	232	38	--	--
Total	M bd. ft.[a]	232	38	232	38	--	--
Pulpwood:							
Softwood	Std. cords[b]	13,722	1,166	8,912	757	4,810	409
Hardwood	Std. cords[b]	10,907	927	3,351	285	7,556	642
Total	Std. cords[b]	24,629	2,093	12,263	1,042	12,366	1,051
Piling:							
Softwood	M linear ft.	--	--	--	--	--	--
Hardwood	M linear ft.	2	1	2	1	--	--
Total	M linear ft.	2	1	2	1	--	--
Poles:							
Softwood	M pieces	1	13	1	13	--	--
Hardwood	M pieces	2	1	2	1	--	--
Total	M pieces	3	14	3	14	--	--

Total	M pieces	3	14	3	14	--	--
Softwood	M pieces	45	29	45	29	--	--
Hardwood	M pieces	--	--	--	--	--	--
Total	M pieces	45	29	45	29	--	--
Other:							
Softwood	M cu. ft.	465	465	8	8	457	457
Hardwood	M cu. ft.	516	516	198	198	318	318
Total	M cu. ft.	981	981	206	206	775	775
Total industrial products:							
Softwood	M cu. ft.		8,711		7,845		866
Hardwood	M cu. ft.		6,778		5,818		960
Total	M cu. ft.		15,489		13,663		1,826
Fuelwood:							
Softwood	Std. cords	3,845	308	845	68	3,000	240
Hardwood	Std. cords	11,215	897	5,815	465	5,400	432
Total	Std. cords	15,060	1,205	6,660	533	8,400	672
All products:[d]							
Softwood	M cu. ft.		9,019		7,913		1,106
Hardwood	M cu. ft.		7,675		6,283		1,392
Total	M cu. ft.		16,694		14,196		2,498

a/ International 1/4-inch rule.

b/ Rough wood basis, includes chips converted to equivalent standard cords.

c/ Includes handle, roller, and dimension bolts; pickets and stakes; charcoalwood; horticultural mulch, and novelty items.

d/ Does not include 1,069 M cubic feet of softwood and 912 M cubic feet of hardwood residues used for agricultural bedding.

Table 22.--Output of roundwood products, by source, softwoods and hardwoods, Massachusetts, 1971

(In thousands of cubic feet)

Product and species group	All sources	Growing-stock trees a/			Rough and rotten trees a/	Salvable dead trees a/	Other sources b/
		Total	Sawtimber	Poletimber			
PRINCIPAL INDUSTRIAL PRODUCTS							
Sawlogs:							
Softwood	7,038	6,104	5,908	196	--	46	888
Hardwood	5,295	5,084	4,838	246	23	--	188
Total	12,333	11,188	10,746	442	23	46	1,076
Veneer logs and bolts:							
Softwood	--	--	--	--	--	--	--
Hardwood	38	37	37	--	--	--	1
Total	38	37	37	--	--	--	1
Pulpwood:							
Softwood	757	650	270	380	3	3	101
Hardwood	285	162	--	162	--	--	123
Total	1,042	812	270	542	3	3	224
MISCELLANEOUS INDUSTRIAL PRODUCTS							
Piling:							
Softwood	--	--	--	--	--	--	--
Hardwood	1	1	1	--	--	--	--
Total	1	1	1	--	--	--	--
Poles:							
Softwood	13	13	11	2	--	--	--
Hardwood	1	1	--	1	--	--	--
Total	14	14	11	3	--	--	--

Posts (round and split):							
Softwood	29	10	--	10	--	17	2
Hardwood	--	--	--	--	--	--	--
Total	29	10	--	10	--	17	2
Other:							
Softwood	8	2	--	2	--	5	1
Hardwood	198	130	85	45	34	7	27
Total	206	132	85	47	34	12	28
			TOTAL INDUSTRIAL PRODUCTS				
Softwood	7,845	6,779	6,189	590	3	71	992
Hardwood	5,818	5,415	4,961	454	57	7	339
Total	13,663	12,194	11,150	1,044	60	78	1,331
			NONINDUSTRIAL PRODUCTS				
Fuelwood:							
Softwood	68	24	--	24	--	39	5
Hardwood	465	305	199	106	80	16	64
Total	533	329	199	130	80	55	69
			ALL PRODUCTS				
Softwood	7,913	6,803	6,189	614	3	110	997
Hardwood	6,283	5,720	5,160	560	137	23	403
Total	14,196	12,523	11,349	1,174	140	133	1,400

a/ On commercial forest land.

b/ Includes trees less than 5.0 inches in diameter, tree tops and limbs from commercial forest areas, or any material from noncommercial forest land or nonforest land such as fence rows and suburban areas.

Table 23.--Timber removals from growing stock and sawtimber on commercial forest land, by items, softwoods and hardwoods, Massachusetts, 1971

Item	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Thousand cubic feet			Thousand board feet[a/]		
Roundwood products:						
Sawlogs	11,188	6,104	5,084	48,656	26,837	21,819
Veneer logs and bolts	37	--	37	167	--	167
Pulpwood	812	650	162	984	984	--
Piling	1	--	1	5	--	5
Poles	14	13	1	50	50	--
Posts	10	10	--	--	--	--
Other	132	2	130	382	--	382
Fuelwood	329	24	305	896	--	896
All products	12,523	6,803	5,720	51,140	27,871	23,269
Logging residues	1,753	565	1,188	1,277	638	639
Other removals	17,165	6,536	10,629	28,865	12,356	16,509
Total removals	31,441	13,904	17,537	81,282	40,865	40,417

[a/] International 1/4-inch rule.

Table 24.--Volume of unused residues at sawmills,[a] by type of residue for softwoods and hardwoods, Massachusetts, 1971

(In thousands of cubic feet)

Type of residue	Softwoods	Hardwoods	All species
Coarse[b]	820.7	352.0	1,172.7
Fine [c]	93.5	67.2	160.7
Total	914.2	419.2	1,333.4

[a] The sawmill industry was the only industry in Massachusetts with unused residues.

[b] Material, such as slabs and edgings.

[c] Material, such as sawdust and shavings.

Table 25.--Area by land classes and counties, Massachusetts, 1972

County	Total land area[a]	Nonforest land area	Forest-land area		
			Non-commercial[b]	Commercial	Sampling error [c]
		Thousand acres			Percent
Barnstable	251.6	174.4	7.2	70.0	18
Berkshire	601.9	151.5	22.2	428.2	6
Bristol	354.6	160.1	8.8	185.7	9
Dukes	66.5	66.5	--	--	--
Essex	316.1	188.1	5.7	122.3	13
Franklin	453.3	108.6	15.1	329.6	5
Hampden	397.8	138.0	26.6	233.2	6
Hampshire	338.8	101.8	10.9	226.1	5
Middlesex	528.1	294.5	9.2	224.4	10
Nantucket	29.4	29.4	--	--	--
Norfolk	252.2	125.9	15.6	110.7	11
Plymouth	418.7	182.4	9.6	226.7	8
Suffolk	35.6	35.6	--	--	--
Worcester	968.5	304.0	23.7	640.8	4
Total	5,013.1	2,060.8	154.6	2,797.7	2

[a] Source: Areas of Massachusetts: 1960, Area Measurement Report, Bureau of the Census.

[b] Includes unproductive and productive-reserved forest land.

[c] In percent for commercial forest land, at the 68 percent probability level.

Table 26.--Area of commercial forest land, by ownership classes and counties, Massachusetts, 1972

(In thousands of acres)

County	Public-owned			Private-owned		Total
	Other federal	State	County and municipal	Farmer-owned	Other private	
Barnstable	5.3	4.0	2.0	1.7	57.0	70.0
Berkshire	.1	69.1	30.9	30.1	298.0	428.2
Bristol	.2	5.0	7.5	12.2	160.8	185.7
Essex	--	8.2	1.6	10.4	102.1	122.3
Franklin	--	56.3	4.6	39.7	229.0	329.6
Hampden	--	8.8	26.0	17.2	181.2	233.2
Hampshire	--	18.5	17.8	28.1	161.7	226.1
Middlesex	3.0	8.4	5.6	13.6	193.8	224.4
Norfolk	1.0	2.8	3.0	6.5	97.4	110.7
Plymouth	--	9.5	8.0	34.3	174.9	226.7
Worcester	--	49.5	8.7	59.8	522.8	640.8
STATE	9.6	240.1	115.7	253.6	2,178.7	2,797.7

Table 27.--Area of commercial forest land, by stand-size classes and counties, Massachusetts, 1972

(In thousands of acres)

County	Sawtimber stands	Poletimber stands	Sapling-seedling stands	Nonstocked areas	Total
Barnstable	18.3	15.4	33.0	3.3	70.0
Berkshire	211.6	143.6	64.4	8.6	428.2
Bristol	56.1	59.6	65.6	4.4	185.7
Essex	25.0	39.2	55.6	2.5	122.3
Franklin	122.3	113.7	88.1	5.5	329.6
Hampden	93.0	87.5	48.8	3.9	233.2
Hampshire	90.5	79.0	52.1	4.5	226.1
Middlesex	50.8	76.6	93.1	3.9	224.4
Norfolk	22.5	37.0	48.6	2.6	110.7
Plymouth	77.9	57.2	81.8	9.8	226.7
Worcester	166.1	238.4	226.4	9.9	640.8
Total	934.1	947.2	857.5	58.9	2,797.7

Table 28.--Area of commercial forest land, by forest types and counties, Massachusetts, 1972

(In thousands of acres)

County	White pine-red pine-hemlock	Spruce fir	Pitch pine	Oak-pine	Oak-hickory	Elm-ash-red maple	Maple-beech-birch	Aspen-birch	Total
Barnstable	20.2	0.6	4.6	6.3	11.2	19.5	6.5	1.1	70.0
Berkshire	95.4	8.5	5.5	16.7	59.8	97.1	135.0	10.2	428.2
Bristol	62.2	2.1	7.8	15.8	35.2	50.4	9.8	2.4	185.7
Essex	23.5	.3	2.8	9.5	31.6	43.6	6.0	5.0	122.3
Franklin	72.4	5.0	5.5	20.4	69.7	90.7	57.9	8.0	329.6
Hampden	42.6	2.6	2.2	17.7	51.5	60.3	51.7	4.6	233.2
Hampshire	46.0	2.9	2.7	14.4	46.4	58.2	50.5	5.0	226.1
Middlesex	43.8	.6	5.0	18.6	58.3	79.2	9.9	9.0	224.4
Norfolk	18.0	.4	2.9	9.4	29.5	40.1	5.4	5.0	110.7
Plymouth	76.3	2.6	17.3	19.4	33.9	56.0	18.1	3.1	226.7
Worcester	131.8	3.0	17.6	69.4	175.2	200.2	25.2	18.4	640.8
Total	632.2	28.6	73.9	217.6	602.3	795.3	376.0	71.8	2,797.7

Table 29.--Net volume of growing stock and sawtimber on commercial forest land, by stand-size classes and counties, Massachusetts, 1972

County	Sawtimber stands	Poletimber stands	Other stands	Total	Sampling error of total
		Million cubic feet			Percent
Barnstable	34.1	21.3	13.4	68.8	27
Berkshire	359.5	206.8	41.1	607.4	9
Bristol	104.6	84.1	34.1	222.8	17
Essex	41.8	54.3	24.8	120.9	21
Franklin	199.6	162.3	48.5	410.4	11
Hampden	160.0	123.4	27.2	310.6	12
Hampshire	152.2	111.9	28.2	292.3	12
Middlesex	89.3	105.8	42.4	237.5	15
Norfolk	39.0	51.5	21.0	111.5	19
Plymouth	156.0	83.6	35.4	275.0	15
Worcester	299.7	329.4	106.6	735.7	8
Total	1,635.8	1,334.4	422.7	3,392.9	3
		Million board feet[a]			Percent
Barnstable	94.4	24.0	20.8	139.2	44
Berkshire	886.2	277.3	86.8	1,250.3	12
Bristol	293.3	101.7	55.2	450.2	27
Essex	110.8	66.6	34.8	212.2	30
Franklin	493.0	207.0	82.4	782.4	17
Hampden	406.6	159.6	49.3	615.5	18
Hampshire	380.1	143.8	51.9	575.8	18
Middlesex	238.2	128.4	61.4	428.0	24
Norfolk	103.9	61.3	29.6	194.8	30
Plymouth	424.7	96.1	57.4	578.2	25
Worcester	812.7	394.4	158.3	1,365.4	14
Total	4,243.9	1,660.2	687.9	6,592.0	4

[a] International 1/4-inch rule.

Table 30.--Net volume of growing stock and sawtimber on commercial forest land, by forest types and counties, Massachusetts, 1972

County	White pine-red pine-hemlock	Spruce-fir	Pitch pine	Oak-pine	Oak-hickory	Elm-ash-red maple	Maple-beech-birch	Aspen-birch	Total
Million cubic feet									
Barnstable	31.9	1.4	2.8	3.6	9.2	14.8	4.5	0.6	68.8
Berkshire	166.8	11.9	5.7	27.2	82.9	119.5	180.9	12.5	607.4
Bristol	100.9	4.6	6.1	16.0	36.3	45.2	12.1	1.6	222.8
Essex	35.0	.6	1.9	12.0	29.9	34.1	4.5	2.9	120.9
Franklin	117.8	7.0	3.8	27.4	82.0	89.7	73.3	9.4	410.4
Hampden	76.0	4.2	2.4	24.7	64.9	65.7	68.6	4.1	310.6
Hampshire	79.1	4.1	2.5	19.2	57.0	60.2	65.4	4.8	292.3
Middlesex	70.0	1.4	4.3	24.5	58.7	64.0	10.2	4.4	237.5
Norfolk	28.9	1.0	1.7	11.9	29.6	31.0	5.0	2.4	111.5
Plymouth	135.4	5.8	14.3	13.7	32.5	50.7	21.2	1.4	275.0
Worcester	222.4	7.0	13.9	84.0	194.3	173.9	30.7	9.5	735.7
Total	1,064.2	49.0	59.4	264.2	677.3	748.8	476.4	53.6	3,392.9
Million board feet[a]									
Barnstable	80.6	2.6	7.2	6.6	11.6	23.7	6.2	0.7	139.2
Berkshire	368.0	31.6	17.1	78.4	164.6	219.5	357.9	13.2	1,250.3
Bristol	259.8	8.2	17.9	29.7	50.0	68.8	13.9	1.9	450.2
Essex	84.7	1.0	5.9	21.5	43.8	46.5	5.4	3.4	212.2
Franklin	267.1	18.5	11.7	55.2	138.8	143.6	136.6	10.9	782.4
Hampden	176.1	10.2	7.5	54.9	114.2	115.6	132.5	4.5	615.5
Hampshire	178.5	10.9	7.9	42.3	102.6	102.8	125.4	5.4	575.8
Middlesex	172.8	2.6	13.1	43.5	87.6	91.5	12.2	4.7	428.0
Norfolk	71.7	1.7	5.1	20.7	44.1	43.2	5.9	2.4	194.8
Plymouth	349.9	10.5	38.1	25.3	42.8	87.0	23.5	1.1	578.2
Worcester	563.7	12.5	40.8	153.7	291.3	261.4	32.7	9.3	1,365.4
Total	2,572.9	110.3	172.3	531.8	1,091.4	1,203.6	852.2	57.5	6,592.0

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[a] International 1/4-inch rule.

Table 31.--Net volume of growing stock on commercial forest land, by species, tree classes, and counties, Massachusetts, 1972

(In millions of cubic feet)

Species	Barnstable	Berkshire	Bristol	Essex	Franklin	Hampden
BY SPECIES						
White pine	26.0	111.5	77.4	34.4	87.0	61.6
Pitch pine	3.1	6.4	7.9	2.6	5.4	3.3
Hemlock	2.6	69.8	10.9	3.5	35.8	24.9
Other softwoods	3.7	18.9	11.1	2.8	11.8	8.2
Total softwoods	35.4	206.6	107.3	43.3	140.0	98.0
Select white oaks	2.6	14.6	8.6	5.8	15.2	13.0
Select red oaks	5.4	43.5	22.2	19.2	47.2	37.2
Other oaks	5.2	26.4	21.0	13.3	32.1	24.2
Hickory	1.2	6.5	4.6	2.8	7.3	4.5
Sugar maple	1.4	67.7	4.2	1.4	27.5	24.8
Soft maples	10.8	87.4	32.6	23.4	62.9	45.9
Sweet birch	.8	17.2	3.1	2.1	10.2	7.0
Yellow birch	1.0	18.6	3.2	1.0	8.8	6.9
Paper birch	.9	21.6	3.4	2.8	12.6	9.6
Beech	.6	28.2	2.2	.6	11.9	11.0
White ash	1.3	24.5	3.4	1.6	11.0	9.8
Black cherry	1.0	20.6	3.2	2.1	11.2	9.4
Aspen	.7	15.1	1.9	.6	7.0	5.4
Elm	.2	2.8	.6	.4	2.2	1.1
Other hardwoods	.3	6.1	1.3	.5	3.3	2.8
Total hardwoods	33.4	400.8	115.5	77.6	270.4	212.6
All species	68.8	607.4	222.8	120.9	410.4	310.6
BY TREE CLASSES						
Sawtimber trees	34.9	315.6	113.3	53.5	197.9	155.3
Poletimber trees	33.9	291.8	109.5	67.4	212.5	155.3

Species	Hampshire	Middlesex	Norfolk	Plymouth	Worcester	Total
			BY SPECIES			
White pine	57.5	69.9	31.0	114.0	206.9	877.2
Pitch pine	3.5	4.9	2.0	12.6	16.4	68.1
Hemlock	25.9	6.4	2.5	10.2	23.4	215.9
Other softwoods	7.7	5.6	3.0	13.2	20.1	106.1
Total softwoods	94.6	86.8	38.5	150.0	266.8	1,267.3
Select white oaks	10.9	12.3	6.1	9.8	43.1	142.0
Select red oaks	31.8	37.4	18.7	20.5	121.2	404.3
Other oaks	21.2	26.5	12.9	20.2	87.3	290.3
Hickory	4.5	5.5	2.5	4.9	16.4	60.7
Sugar maple	24.2	3.0	1.3	7.2	8.6	171.3
Soft maples	43.5	42.3	20.4	35.5	117.5	522.2
Sweet birch	6.9	3.9	2.0	2.8	10.6	66.6
Yellow birch	7.3	2.0	.7	3.9	5.7	59.1
Paper birch	9.7	4.9	2.4	3.5	13.2	84.6
Beech	10.4	1.5	.8	2.5	6.1	75.8
White ahs	9.2	3.3	1.4	5.0	9.8	80.3
Black cherry	8.5	4.3	2.1	3.9	15.2	81.5
Aspen	5.6	1.5	.7	2.9	4.9	46.3
Elm	1.3	.9	.4	1.0	3.1	14.0
Other hardwoods	2.7	1.4	.6	1.4	6.2	26.6
Total hardwoods	197.7	150.7	73.0	125.0	468.9	2,125.6
All species	292.3	237.5	111.5	275.0	735.7	3,392.9
			BY TREE CLASSES			
Sawtimber	145.5	108.1	49.2	145.6	344.8	1,663.7
Poletimber	146.8	129.4	62.3	129.4	390.9	1,729.2
All classes	292.3	237.5	111.5	275.0	735.7	3,392.9

Table 32.--Net volume of sawtimber on commercial forest land, by species and counties, Massachusetts, 1972

(In millions of board feet)[a/]

Species	Barnstable	Berkshire	Bristol	Essex	Franklin	Hampden
White pine	76.8	347.6	233.2	102.0	260.8	187.5
Pitch pine	7.3	17.7	21.2	7.5	15.7	9.7
Hemlock	5.0	148.6	20.1	7.0	75.5	54.2
Other softwoods	9.2	52.8	28.6	5.3	31.6	21.2
Total softwoods	98.3	566.7	303.1	121.8	383.6	272.6
Select white oaks	5.0	25.0	13.2	8.2	21.4	20.6
Select red oaks	11.4	112.2	45.5	32.7	94.1	80.9
Other oaks	8.1	64.4	33.4	21.9	62.5	50.0
Hickory	1.9	15.5	7.9	4.5	13.4	6.9
Sugar maple	1.5	113.9	4.5	.7	43.6	42.1
Soft maples	7.2	117.8	23.1	14.3	65.8	50.7
Sweet birch	.2	20.8	1.6	1.4	10.5	8.1
Yellow birch	1.3	20.3	4.0	1.2	8.5	7.8
Paper birch	.4	25.2	2.3	1.4	12.2	10.7
Beech	.8	61.6	2.7	.4	22.3	23.1
White ash	1.8	53.8	4.2	1.6	17.5	20.2
Black cherry	.7	16.1	2.7	1.2	9.6	6.9
Aspen	.1	22.8	.5	.2	9.1	8.5
Elm	.4	4.2	1.0	.2	3.7	1.2
Other hardwoods	.1	10.0	.5	.5	4.6	5.2
Total hardwoods	40.9	683.6	147.1	90.4	398.8	342.9
All species	139.2	1,250.3	450.2	212.2	782.4	615.5

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Species	Hampshire	Middlesex	Norfolk	Plymouth	Worcester	Total
White pine	174.5	204.4	90.9	334.9	611.0	2,623.6
Pitch pine	10.5	14.2	5.6	30.3	46.5	186.2
Hemlock	55.2	14.0	5.4	19.1	52.3	456.4
Other softwoods	20.9	11.4	6.3	34.7	47.0	269.0
Total softwoods	261.1	244.0	108.2	419.0	756.8	3,535.2
Select white oaks	16.8	17.9	8.5	17.5	64.4	218.5
Select red oaks	69.9	66.6	32.6	45.7	228.6	820.2
Other oaks	44.6	45.4	21.6	32.9	154.1	538.9
Hickory	7.6	7.9	3.3	7.7	20.5	97.1
Sugar maple	40.6	1.9	.9	7.6	7.7	265.0
Soft maples	48.8	27.0	12.3	23.1	74.5	464.6
Sweet birch	7.8	2.6	1.3	1.1	6.6	62.0
Yellow birch	8.1	2.0	.6	3.9	5.8	63.5
Paper birch	10.6	2.6	1.1	1.8	7.6	75.9
Beech	21.0	1.2	.7	3.5	6.5	143.8
White ash	17.6	3.4	1.3	7.5	8.7	137.6
Black cherry	6.8	2.9	1.3	3.7	11.8	63.7
Aspen	8.5	.3	.1	.5	.8	51.4
Elm	1.6	.9	.3	2.2	3.8	19.5
Other hardwoods	4.4	1.4	.7	.5	7.2	35.1
Total hardwoods	314.7	184.0	86.6	159.2	608.6	3,056.8
All species	575.8	428.0	194.8	578.2	1,365.4	6,592.0

a/ International 1/4-inch rule.

Peters, John R., and Teresa M. Bowers.
1977. **Forest statistics for Massachusetts.** Northeast. For. Exp. Stn., Upper Darby, Pa.
43 p. (USDA For. Serv. Resour. Bull. NE-48)

A report on the second inventory of the forest resources of Massachusetts, including trends of change in commercial forest-land acreage, volume of growing stock, and sawtimber volume. The report contains 32 tables of statistical data on forest land; timber volume; annual growth, removals, and mortality; and output of timber products.

(745)--905.2

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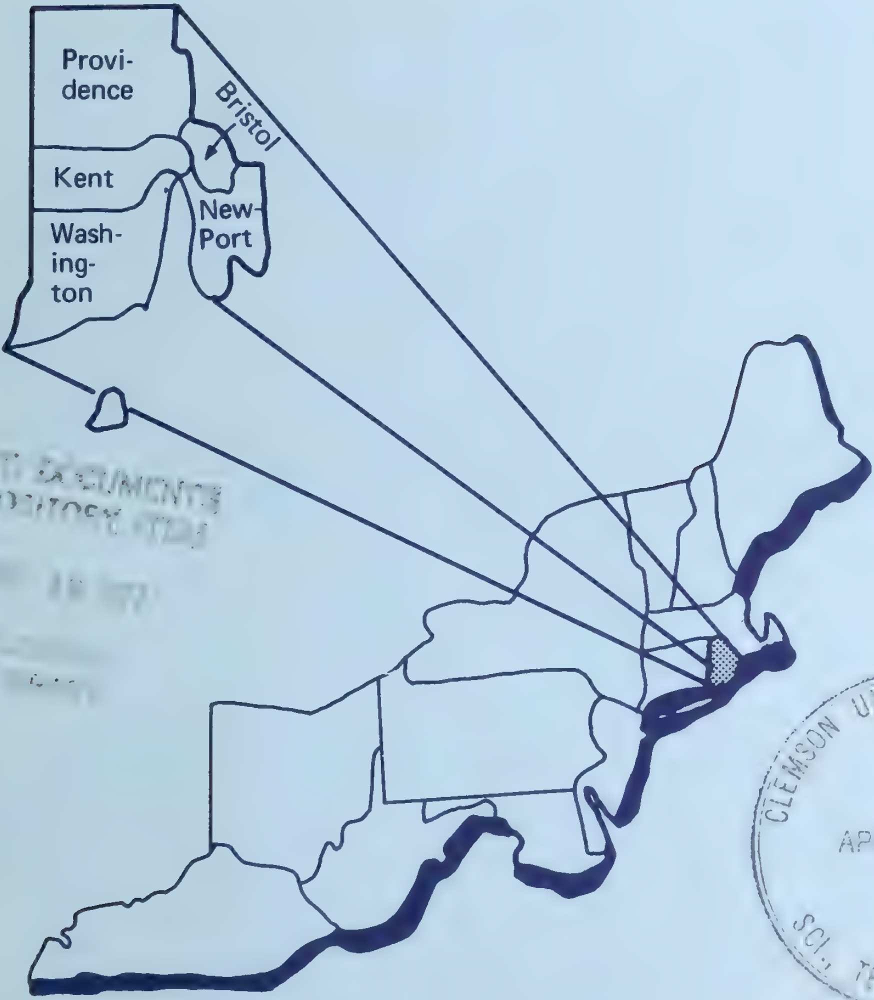

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NORTHEASTERN FOREST EXPERIMENT STATION
6816 MARKET STREET, UPPER DARBY, PA. 19082

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FOREST STATISTICS for RHODE ISLAND

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THE RHODE ISLAND RESURVEY

THIS REPORT contains data for the second inventory of the forest resources of Rhode Island. The inventory was completed in 1971 by the Northeastern Forest Experiment Station in cooperation with the Rhode Island Department of Natural Resources.

The first inventory of Rhode Island was completed in 1952. Because of many differences in standards and measurement techniques, the results of the current inventory are not directly comparable to the initial inventory. The trends in the resource, after the initial data have been adjusted to the resurvey standards, show these changes:

	1953	*1972*	*Change*
COMMERCIAL FOREST LAND (thousand acres):	430.5	395.3	−35.2
GROWING STOCK VOLUME (million cubic feet):			
Softwoods	21.8	75.0	53.2
Hardwoods	166.8	272.2	105.4
Total	188.6	347.2	158.6
SAWTIMBER VOLUME (million board feet):			
Softwoods	52.9	124.6	71.7
Hardwoods	228.1	352.1	124.0
Total	281.0	476.7	195.7

The inventory statistics reported here were obtained through a sampling procedure that utilizes recent aerial photography, the partial remeasurement of ground samples from the initial inventory, and the establishment of new ground-sample locations. In Rhode Island, this required the remeasurement of 86 plots, the interpretation of 2,088 points on aerial photographs into land-use and cubic-foot volume classes, and the location and establishment of 106 on-the-ground measurement locations as a subsample of the photo points. The data thus collected were summarized according to the Sampling with Partial Replacement (SPR) design, using the FINSYS computer system developed by the Northeastern Forest Experiment Station.

The inventory was designed to estimate resource data for the State as a whole. However, estimates for individual counties are also available, based on the photo-plot data for the county, expanded by the on-the-ground measurement subsample for the entire State. This procedure is based on the assumption that certain attributes of the ground plots are homogeneous across county boundaries. Therefore, the user of county data should recognize the limited and variable accuracy of the estimates for individual counties.

The reader may wish to consult other companion publications regarding this resurvey. THE FOREST RESOURCES OF SOUTHERN NEW ENGLAND (Resource Bulletin NE−36, 1974, by Neal P. Kingsley) provides an analysis and interpretation of the forest resource of this region along with an evaluation of the trends since the first inventory. PRIMARY WOOD-PRODUCT INDUSTRIES OF SOUTHERN NEW ENGLAND, 1971 (Resource Bulletin NE–30, 1973 by James T. Bones) is a report on a complete canvass of the primary wood manufacturers and an analysis of the trends in industrial wood output since 1952. THE FOREST-LAND OWNERS OF SOUTHERN NEW ENGLAND (Resource Bulletin NE–41, 1976, by Neal P. Kingsley) is a report on a canvass of forest-land owners in the three Southern New England states, including an analysis of their ownership objectives, harvesting practices, and socioeconomic characteristics.

THE FOREST RESOURCE

Rhode Island has 395,300 acres of commercial forest land. This is 59 percent of the State's total land area, it reflects a decrease of 8 percent since 1953, the year of the last survey.[1]

The distribution of commercial forest land by areas of major forest types has changed. The area of the white and red pine type has increased from 2 to 7 percent of the commercial forest land. The elm-ash-red maple type has also increased, from 18 to 29 percent of the commercial forest land, while the areas of the other hardwood types decreased.

As part of the survey, a canvass was made of the attitudes and objectives of the owners of privately-owned commercial forest land. A detailed questionnaire was sent to all owners of forest survey plot-locations that were classified as commercial forest land. Data from the questionnaire reveal that there are more than 14,000 owners of commercial forest land in the State. Of these, 91 percent are individuals, and they own 81 percent of the commercial forest land. About 6 percent of all forest-land owners are corporations; they own 12 percent of the forest land. The remaining 3 percent of the owners are partnerships, associations, undivided estates, and the like. The average owner in Rhode Island holds slightly more than 25 acres of commercial forest land. Only one in every 25 owners has harvested timber from his land.

While the area of commercial forest land has decreased between surveys, the total net volume of growing stock has nearly doubled, and the volume of growing stock per acre of commercial forest land has indeed doubled. Current total net growing-stock volumes are 347.2 million cubic feet (up 84 percent) and 548.3 million board feet (up 95 percent). Current average volumes per acre are 878 cubic feet (up 100 percent) and 1,387 board feet (up 112 percent).

The softwood proportions of total net growing-stock volume have also increased between surveys. Softwoods currently represent 22 percent of the total net cubic-foot volume and 36 percent of the total board-foot volume. In 1953, the respective proportions were 12 and 19 percent.

Individual species currently account for approximately the same percentages of total growing stock volume that were reported in 1953. Of the softwoods, white pine continues to make up about two-thirds of all softwood volume; the remaining one-third consists of nearly equal volumes of red pine and pitch pine. Of the hardwoods, the leading species in cubic-foot volume are red maple (23 percent), northern red oak (18 percent), white oak (19 percent), and other oaks, mostly black and chestnut oak (32 percent). In board feet, the percentages of red maple, northern red oak, and white oak are slightly lower while the percentage of the other oaks is slightly higher.

Growth-and-removal data for the period between surveys show that, for all species combined, average annual net growth exceeded removals by ratios of more than 3 to 1 in cubic feet, and more than 2 to 1 in board feet. For softwoods, the growth-to-removal ratios were approximately 6 to 1 in cubic feet and 9 to 1 in board feet. For hardwoods the ratios were about 2 to 1 in both cubic feet and board feet.

Growing-stock volumes per acre of commercial forest land vary only slightly between counties. Providence County contains 40 percent of the forest land and 42 percent of the growing-stock volume, while Kent County, with 18 percent of the forest land, has 18 percent of the volume in the State.

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[1] Ferguson, R. H., and J. J. McGuire, 1957. The timber resources of Rhode Island. USDA For. Serv. Northeast. For. Exp. Stn. 38 p.

DEFINITION OF TERMS

Land Area Classes

Land area.—(a) Bureau of the Census. The area of dry land and land that is temporarily or partly covered by water, such as marshes, swamps, and river flood plains; streams, sloughs, estuaries, and canals that are less than ⅛ statute mile in width; and lakes, reservoirs, and ponds that are less than 40 acres in area. (b) Forest Survey. The same as the Bureau of the Census, except that the minimum width of streams, etc. is 120 feet and the minimum size of lakes etc. is 1 acre.

Forest land.—Land that is at least 16.7 percent stocked (contains at least 7.5 square feet of basal area) by forest trees of any size, or that formerly had such tree cover and is not currently developed for nonforest use. (Forest trees are woody plants that have a well-developed stem and usually are more than 12 feet in height at maturity.) The minimum area for classification of forest land is 1 acre.

Commercial forest land.—Forest land that is producing or capable of producing crops of industrial wood (more than 20 cubic feet per acre per year) and is not withdrawn from timber utilization. (Industrial wood: all roundwood products, except fuelwood.)

Ownership Classes

Federal.—Lands (other than National Forests) that are administered by Federal agencies.

State.—Lands that are owned by the state or leased to a state for 50 years or more.

County and municipal.—Lands that are owned by counties and local public agencies or municipalities or leased to them for 50 years or more.

Forest industry.—Lands that are owned by companies or individuals operating wood-using plants.

Miscellaneous private.—Privately owned lands other than forest-industry and farmer-owned lands.

Farmer-owned.—Lands that are owned by farm operators, whether part of the farmstead or not. Excludes land leased by farm operators from non-farm owners.

Stand-Size Classes

Stand.—A growth of trees (see definitions under "Tree Classes") on a minimum of 1 acre of forest land that is at least 16.7 percent stocked by forest trees of any size.

Sawtimber stands.—Stands that are at least 16.7 percent stocked with growing-stock trees, with half or more of total stocking in sawtimber or poletimber trees, and with sawtimber stocking at least equal to poletimber stocking.

Poletimber stands.—Stands that are at least 16.7 percent stocked with growing-stock trees of which half or more of this stocking is in poletimber and/or sawtimber trees and in which poletimber stocking exceeds that of sawtimber.

Sapling-seedling stands.—Stands that are at least 16.7 percent stocked with growing-stock trees of which more than half of the stocking is sapling and/or seedlings.

Nonstocked areas.—Commercial forest land that is less than 16.7 percent stocked with growing-stock trees.

Tree Classes

Growing-stock trees.—Live trees of commercial species that are classified as sawtimber, poletimber, saplings, and seedlings; that is, all live trees of commercial species except rough and rotten trees.

Rotten trees.—Live trees of commercial species that do not contain at least one 12-foot sawlog or two nontiguous sawlogs, each 8 feet or longer, now or prospectively, and do not meet regional specifications for freedom from defect primarily because of rot; that is, when more than 50 percent of the cull volume in a tree is rotten.

Rough trees.—(a) The same as above, except that rough trees do not meet regional specifications for freedom from defect primarily because of roughness or poor form, and (b) all live trees that are of noncommercial species.

Forest Types

Forest type.—A classification of forest land based upon the species forming a plurality of basal area of live trees. The many local forest types in the Northeast were combined into the following major forest types:

White pine-red pine-hemlock.—Forests in which eastern white pine, red pine, or hemlock, singly or in combination, make up a plurality of the stocking. (Common associates include aspen, birch, and maple.)

Spruce-fir.—Forests in which spruce or true firs, singly or in combination, comprise a plurality of the stocking. (Common associates include white cedar, tamarack, maple, birch, and hemlock.)

Pitch pine-eastern redcedar.—Forests in which pitch pine or eastern redcedar, singly or in combination, make up a plurality of the stocking. (Common associates include oak and hickory.)

Oak-pine.—Forests in which oaks or hickory, singly or in combination, make up a plurality of the stocking, but in which pitch pine and/or eastern redcedar make up 25 to 50 percent of the stocking.

Oak-hickory.—Forests in which oaks or hickory, singly or in combination, make up a plurality of the stocking, except where pitch pine and/or eastern redcedar make up 25 or 50 percent, in which case the stand would be classified oak-pine. (Common associates include yellow-poplar, elm, and red maple.)

Elm-ash-red-maple.—Forests in which elm, ash, or red maple, singly or in combination, make up a plurality of the stocking. (Common associates include beech and sugar maple.)

Maple-beech-birch.—Forests in which sugar maple, beech, or yellow birch, singly or in combination, make up a plurality of the stocking. (Common associates include sweet birch, black cherry, hemlock, and white pine.)

Class of Timber

Sawtimber trees.—Live trees of commercial species, (a) that are of the following minimum diameters at breast height—softwoods 9.0 inches and hardwoods 11.0 inches, and (b) that contain at least one 12-foot or two noncontiguous 8-foot merchantable sawlogs and that meet regional specifications for freedom from defect.

Poletimber trees.—Live trees of commercial species that meet regional specifications of soundness and form, and are at least 5.0 inches dbh but are smaller than sawtimber size.

Saplings.—Live trees of commercial species that are 1.0 to 5.0 inches dbh and of good form and vigor.

Seedlings.—Live trees of commercial species that are less than 1.0 inch dbh and are expected to survive.

Timber Measurement and Volume

Growing-stock volume.—Net volume, in cubic feet, of live growing-stock trees that are 5.0 inches dbh and larger, from a 1-foot stump to a minimum 4.0-inch top diameter outside bark of the central stem, or to the point where the central stem breaks into limbs. Net volume equals gross volume less deduction for rot and/or sweep and crook.

Sawtimber volume.—Net volume in board feet, International ¼-inch rule, of merchantable sawlogs in live sawtimber trees. Net volume equals gross volume less deductions for rot, sweep, and other defects that affect use for lumber.

Annual Net Growth and Timber Removals

Average annual net growth of growing stock.—The change (resulting from natural causes) in volume of sound wood in sawtimber and poletimber trees during the period between surveys, divided by the length of the period. (Components of annual net growth of growing stock include the increment in net volume of trees present at the beginning of the period and surviving to its end, plus net volume of trees reaching poletimber size during the period, minus the net volume of trees that died during the period, minus the net volume of trees that became rough or rotten trees during the period, cull increment.)

Average annual growing-stock removals.—The net cubic-foot volume of growing-stock trees removed by harvesting or killed in logging, cultural operations such as timber-stand improvement, and land-clearing; or changes in land use during the period between surveys, converted to an annual basis.

Average annual net growth of sawtimber—The change (resulting from natural causes) in net board-foot volume of sawtimber during the period between surveys, divided by the length of the period. (Components of annual net growth of sawtimber include the increment in net volume of sawtimber trees present at the beginning of the period and surviving to its end, plus the net volume of trees reaching sawtimber size during the period, minus the net volume of sawtimber trees that died during the period, minus the net volume of sawtimber trees that became rough or rotten trees during the period between surveys, cull increment.)

Average annual sawtimber removals.—The net board-foot volume of sawtimber trees removed by harvesting or killed in logging, cultural operations such as timber-stand improvement, and land-clearing; or changes in land use during the period between surveys, converted to an annual basis.

Annual removals trend-level.—The estimated removals of growing stock or sawtimber for a specific year that are consistent with the trend of removals during the period between surveys and with the current inventory.

Logging residues.—The unused growing-stock volume of trees cut for products and the total growing-stock volume of trees destroyed in the course of logging but not removed for products.

Other removals.—The growing-stock volume of trees that were removed from the inventory and not used for products, in cultural operations (weeding, thinning, etc.), land-clearing, and reclassification of some commercial forest land as noncommercial forest land.

Plant byproducts.—Wood products such as slabs, edgings, and veneer cores that are obtained incidental to the production of timber products and are utilized in the manufacture of other timber products. (Bark is not included.)

Plant residues.—Wood material produced incidental to the production of timber products but not utilized.

Roundwood products.—Logs, bolts, or other round sections cut from growing stock or nongrowing stock for industrial or nonindustrial uses.

Timber products.—Roundwood products and plant byproducts from all sources.

Timber removals.—The growing-stock volume of trees removed from the inventory for roundwood products, plus logging residues and other removals.

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Table 1.--Area by land classes, Rhode Island, 1972

Land class	Area	
	Thousand acres	Percent
Forest land:		
Commercial	395.3	59
Productive-reserved	8.9	1
Total forest land	404.2	60
Nonforest land:		
Cropland a/	27.3	4
Pasture a/	4.7	1
Other b/	235.2	35
Total nonforest land	267.2	40
Total area c/	671.4	100

a/ Source: 1969 and 1964 Census of Agriculture. Total cropland includes cropland used for pasture. Pasture total based upon ratios developed from the 1964 Census report. Data extrapolated to 1972.

b/ Includes swampland, industrial and urban areas, other nonforest land, and 4,600 acres classed as water by Forest Survey standards, but defined by the Bureau of the Census as land.

c/ Source: United States Bureau of the Census, Areas of Rhode Island, 1960 (April 1970).

Table 2.--Area of commercial forest land, by ownership classes, Rhode Island, 1972

Ownership class	Area a/	
	Thousand acres	Percent
State	20.1	5
County and municipal	12.0	3
Total public	32.1	8
Farmer-owned	24.6	6
Miscellaneous private:		
Individual b/	295.9	75
Corporate	42.7	11
Total miscellaneous private	338.6	86
All ownerships	395.3	100

a/ Estimates of area in each private ownership class are based upon the forest-land ownership study by the NEFES. Public ownerships are from ownership records.

b/ Includes acreage owned by business partnerships and organizations such as churches, Boy Scouts of America, and associations.

Table 3.--Area of commercial forest land, by ownership, stand-size, and stand-volume classes, Rhode Island, 1972

(In thousands of acres)

Stand-size and stand-volume class	All ownerships	Other public	Farmer and other
BY STAND-SIZE CLASS			
Sawtimber	87.9	5.3	82.6
Poletimber	133.0	5.4	127.6
Sapling-seedling	168.3	21.4	146.9
Nonstocked areas	6.1	--	6.1
All classes	395.3	32.1	363.2
BY STAND-VOLUME-PER-ACRE CLASS[a/]			
Less than 1,500	266.2	21.4	244.8
1,500 to 5,000	104.0	10.7	93.3
More than 5,000	25.1	--	25.1
All classes	395.3	32.1	363.2

a/ In board feet, International 1/4-inch rule.

Table 4.--Area of commercial forest land, by stocking classes based on selected stand components, Rhode Island, 1972

(In thousands of acres)

Stocking class a/ (percent)	Stocking classified in terms of--				
	All trees	Growing-stock trees			Rough and rotten trees
		Total	Desirable	Acceptable	
Overstocked:					
150	6.1	--	--	--	--
140 to 150	25.0	--	--	--	--
130 to 140	59.5	6.3	--	6.3	--
Total	90.6	6.3	--	6.3	--
Fully stocked:					
120 to 130	44.2	34.9	--	28.6	--
110 to 120	107.0	6.3	--	6.3	--
100 to 110	75.3	69 1	--	50.3	--
Total	226.5	110.3	--	85.2	--
Medium stocked:					
90 to 100	41.1	81.4	--	93.9	--
80 to 90	6.3	62.6	--	50.1	--
70 to 80	6.1	53.6	--	72.5	12.7
60 to 70	6.5	25.2	--	31.5	12.1
Total	60.0	222.8	--	248.0	24.8
Poorly stocked:					
50 to 60	18.2	6.1	--	6.1	25.3
40 to 50	--	25.1	--	25.1	55.8
30 to 40	--	6.1	--	6.1	43.7
20 to 30	--	12.6	--	12.5	69.0
10 to 20	--	--	31.5	--	129.0
Less than 10	--	6.0	363.8	6.0	47.7
Total	18.2	55.9	395.3	55.8	370.5
All classes	395.3	395.3	395.3	395.3	395.3

a/ Fully stocked stands are considered to contain 75 to 100 square feet of basal area per acre.

Table 5.--Area of commercial forest land, by ownership potential site productivity, and area-condition classes, Rhode Island, 1972

(In thousands of acres)

Growth-per-acre and area-condition class	All ownerships	Other public	Farmer and other
BY GROWTH-PER-ACRE CLASS[a]			
120 to 165	18.6	--	18.6
85 to 120	35.1	--	35.1
50 to 85	119.5	--	119.5
Less than 50	222.1	32.1	190.0
All classes	395.3	32.1	363.2
BY AREA-CONDITION CLASS[b]			
Class 10-40	--	--	--
Class 50	85.2	5.3	79.9
Class 60	254.2	16.0	238.2
Class 70	55.9	10.8	45.1
All classes	395.3	32.1	363.2

[a] In cubic feet.

[b] Class 10-40.--Areas medium to fully stocked with desirable trees.

Class 50.--Areas poorly stocked with desirable trees, but fully stocked with growing-stock trees.

Class 60.--Areas poorly stocked with desirable trees, but with medium to full stocking of growing-stock trees.

Class 70.--Areas poorly stocked with desirable trees, and poorly stocked with growing-stock trees.

Table 6.--Area of commercial forest land, by forest types, and ownership and stand-size classes, Rhode Island, 1972

(In thousands of acres)

Ownership and stand-size classes	White and red pine	Pitch pine-eastern redcedar	Oak-pine	Oak-hickory	Elm-ash-red maple	Maple-beech-birch	Aspen-birch	Total
BY OWNERSHIP CLASS								
Other public	--	--	5.3	16.0	10.8	--	--	32.1
Farmer and other	28.8	25.2	31.8	156.9	101.8	12.6	6.1	363.2
All ownerships	28.8	25.2	37.1	172.9	112.6	12.6	6.1	395.3
BY STAND-SIZE CLASS								
Sawtimber stands	18.8	--	6.3	31.4	31.4	--	--	87.9
Poletimber stands	3.6	--	6.3	85.2	31.6	6.3	--	133.0
Sapling-seedling stands a/	6.4	25.2	24.5	56.3	49.6	6.3	6.1	174.4
All stands	28.8	25.2	37.1	172.9	112.6	12.6	6.1	395.3

a/ Includes 6,100 acres of nonstocked areas in the elm-ash-red maple forest type.

Table 7.--Area of commercial forest land by local forest types and major forest types, Rhode Island, 1972

(In thousands of acres)

Forest type	Area	
	Local	Major
White and red pine:		
Red pine	6.3	
White pine	22.5	
Total		28.8
Pitch pine-eastern redcedar:		
Eastern redcedar	6.5	
Pitch pine	18.7	
Total		25.2
Oak-pine:		
White pine-red oak-white ash	6.3	
Eastern redcedar-hardwoods	12.4	
Other oak-pines	18.4	
Total		37.1
Oak-hickory:		
Post or bear oak	18.7	
Chestnut oak	6.3	
White oak-red oak-hickory	12.3	
White oak	75.2	
Northern red oak	35.1	
Mixed hardwoods	25.3	
Total		172.9
Elm-ash-red maple:		
Black ash-elm-red maple	112.6	
Total		112.6
Maple-beech-birch:		
Sugar maple-beech-yellow birch	6.3	
Black cherry	6.3	
Total		12.6
Aspen-birch:		
Aspen	6.1	
Total		6.1
All forest types	395.3	395.3

Table 8.--Area of noncommercial forest land, by forest types, Rhode Island, 1972

(In thousands of acres)

Forest type	All areas	Productive-reserved areas	Unproductive areas
Oak-pine	1.4	1.4	--
Oak-hickory	4.5	4.5	--
Elm-ash-red maple	3.0	3.0	--
All types	8.9	8.9	--

Table 9.--Number of trees on commercial forest land, by species groups, tree classes, and diameter classes, Rhode Island, 1972

(In thousands of trees)

DBH class (inches)	Softwoods			Hardwoods		
	Growing-stock trees	Rough and rotten trees	Total	Growing-stock trees	Rough and rotten trees	Total
Saplings:						
1.0 to 2.9	12,226	6,671	18,897	44,324	46,944	91,268
3.0 to 4.9	6,159	1,713	7,872	29,103	15,744	44,847
Total	18,385	8,384	26,769	73,427	62,688	136,115
Poletimber:						
5.0 to 6.9	2,973	776	3,749	19,837	3,988	23,825
7.0 to 8.9	2,425	360	2,785	10,639	2,373	13,012
9.0 to 10.9	--	--	--	5,961	987	6,948
Total	5,398	1,136	6,534	36,437	7,348	43,785
Small sawtimber:						
9.0 to 10.9	1,281	86	1,367	--	--	--
11.0 to 12.9	586	--	586	2,853	637	3,490
13.0 to 14.9	347	--	347	1,356	236	1,592
Total	2,214	86	2,300	4,209	873	5,082
Large sawtimber:						
15.0 to 16.9	292	--	292	460	176	636
17.0 to 18.9	66	--	66	351	163	514
19.0 to 20.9	66	--	66	113	21	134
21.0 to 28.9	54	13	67	114	61	175
29.0 and larger	9	--	9	13	21	34
Total	487	13	500	1,051	442	1,493
All classes	26,484	9,619	36,103	115,124	71,351	186,475

Table 10.--Number of growing-stock trees on commercial forest land, by species and diameter classes, Rhode Island, 1972

(In thousands of trees)

Species	All classes	Diameter class (inches at breast height)									
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
White pine	4,046	1,662	863	377	400	301	272	53	55	54	9
Red pine	1,389	117	678	532	62	--	--	--	--	--	--
Pitch pine	2,209	990	713	329	124	20	20	13	--	--	--
Other softwoods	455	204	171	43	--	26	--	--	11	--	--
Total softwoods	8,099	2,973	2,425	1,281	586	347	292	66	66	54	9
Select white oaks	7,707	2,347	2,976	1,283	517	438	70	68	--	8	--
Select red oaks	7,896	4,152	1,660	1,290	444	199	91	27	33	--	--
Other red oaks a/	11,721	5,136	2,774	1,887	1,223	371	157	79	33	48	13
Hickory	553	355	116	45	--	25	--	--	12	--	--
Soft maples	10,599	6,144	2,398	1,038	492	206	107	133	35	46	--
Yellow birch b/	1,309	654	431	93	63	21	18	29	--	--	--
Other hardwoods	1,912	1,049	284	325	114	96	17	15	--	12	--
Total hardwoods	41,697	19,837	10,639	5,961	2,853	1,356	460	351	113	114	13
All species	49,796	22,810	13,064	7,242	3,439	1,703	752	417	179	168	22

a/ Includes 1,169,000 other white oak trees.

b/ Includes 422,000 sweet birch trees.

Table 11.--Net volume of timber on commercial forest land, by class of timber, softwoods and hardwoods, Rhode Island, 1972

(In millions of cubic feet)

Class of timber	All species	Softwoods	Hardwoods
Sawtimber trees:			
Sawlog portion	122.1	43.4	78.7
Upper-stem portion	25.9	5.6	20.3
All sawtimber trees	148.0	49.0	99.0
Poletimber trees	199.2	26.0	173.2
All growing-stock trees	347.2	75.0	272.2
Rough trees	52.2	6.0	46.2
Rotten trees	7.3	.2	7.1
Total, all trees	406.7	81.2	325.5

Table 12.--Net volume of growing stock and sawtimber on commercial forest land, by ownership, stand-size classes, and forest types, softwoods and hardwoods, Rhode Island, 1972

Ownership, stand size, and forest type	Growing stock (million cubic feet)			Sawtimber (million board feet)[a]		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
BY OWNERSHIP CLASSES						
Other public	17.9	3.0	14.9	27.8	4.3	23.5
Farmer and other	329.3	72.0	257.3	520.5	191.9	328.6
All ownerships	347.2	75.0	272.2	548.3	196.2	352.1
BY STAND-SIZE CLASSES						
Sawtimber stands	128.3	36.8	91.5	300.0	100.7	199.3
Poletimber stands	148.4	11.4	137.0	141.3	27.6	113.7
Sapling-seedling stands	70.1	26.8	43.3	105.6	67.9	37.7
Nonstocked areas	.4	--	.4	1.4	--	1.4
All stands	347.2	75.0	272.2	548.3	196.2	352.1
BY FOREST TYPES						
White and red pines	52.3	43.6	8.7	137.9	123.1	14.8
Pitch pine-eastern redcedar	9.6	6.7	2.9	10.8	9.3	1.5
Oak-pine	23.8	9.8	14.0	48.3	25.8	22.5
Oak-hickory	157.1	8.6	148.5	200.1	16.4	183.7
Elm-ash-red maple	92.1	5.9	86.2	138.6	19.1	119.5
Maple-beech-birch	10.3	--	10.3	7.1	--	7.1
Aspen-birch	2.0	.4	1.6	5.5	2.5	3.0
All types	347.2	75.0	272.2	548.3	196.2	352.1

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a/ International 1/4-inch rule.

Table 13.--Net volume of growing stock on commercial forest land, by species and diameter classes, Rhode Island, 1972

(In millions of cubic feet)

Species	All classes	Diameter class (inches at breast height)									
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
White pine	48.7	7.8	6.1	4.4	6.2	7.0	8.3	2.0	2.7	3.3	0.9
Red pine	11.8	.6	5.0	5.2	1.0	--	--	--	--	--	--
Pitch pine	11.4	1.8	3.1	2.9	1.9	.5	.6	.6	--	--	--
Other softwoods	3.1	.8	.8	.4	--	.5	--	--	.6	--	--
Total softwoods	75.0	11.0	15.0	12.9	9.1	8.0	8.9	2.6	3.3	3.3	.9
Select white oaks	50.1	7.5	15.3	10.0	6.2	7.2	1.6	1.9	--	.4	--
Select red oaks	49.9	14.7	9.5	11.1	6.2	3.8	2.3	.9	1.4	--	--
Other red oaks a/	87.8	17.5	16.4	16.4	16.9	7.5	4.2	2.9	1.4	3.0	1.6
Hickory	3.7	1.4	.8	.4	--	.5	--	--	.6	--	--
Soft maples	61.4	18.3	12.7	9.2	6.7	3.8	2.7	4.3	1.3	2.4	--
Yellow birch b/	7.0	1.7	2.2	.7	.8	.4	.4	.8	--	--	--
Other hardwoods	12.3	3.2	1.6	2.6	1.6	1.7	.4	.4	--	.8	--
Total hardwoods	272.2	64.3	58.5	50.4	38.4	24.9	11.6	11.2	4.7	6.6	1.6
All species	347.2	75.3	73.5	63.3	47.5	32.9	20.5	13.8	8.0	9.9	2.5

a/ Includes 6,400,000 cubic feet of other white oaks.

b/ Includes 1,800,000 cubic feet of sweet birch.

Table 14.--Net volume of sawtimber on commercial forest land, by species and diameter classes, Rhode Island, 1972

(In millions of board feet)a/

Species	All classes	Diameter class (inches at breast height)						
		9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
White pine	145.5	14.2	23.6	28.4	36.0	9.0	11.9	17.4	5.0
Red pine	20.9	17.1	3.8	--	--	--	--	--	--
Pitch pine	23.2	9.3	6.8	2.1	2.3	2.7	--	--	--
Other softwoods	6.6	1.5	--	2.3	--	--	2.8	--	--
Total softwoods	196.2	42.1	34.2	32.8	38.3	11.7	14.7	17.4	5.0
Select white oaks	60.3	--	19.8	25.9	5.7	7.2	--	1.7	--
Select red oaks	52.8	--	18.7	14.9	10.1	3.3	5.8	--	--
Other red oaks b/	135.9	--	54.4	29.4	16.3	11.6	5.9	12.0	6.3
Hickory	4.4	--	--	1.5	--	--	2.9	--	--
Soft maples	73.2	--	19.2	13.0	9.8	16.6	5.1	9.5	--
Yellow birch	8.4	--	2.6	1.3	1.4	3.1	--	--	--
Other hardwoods	17.1	--	4.6	6.1	1.4	1.8	--	3.2	--
Total hardwoods	352.1	--	119.3	92.1	44.7	43.6	19.7	26.4	6.3
All species	548.3	42.1	153.5	124.9	83.0	55.3	34.4	43.8	11.3

a/ International 1/4-inch rule.

b/ Includes 2,900,000 board feet of other white oaks.

Table 15.--Net volume of sawtimber on commercial forest land, by species and quality classes, Rhode Island, 1972

(In millions of board feet)[a]

Species	All classes	Standard-lumber logs			
		Grade 1	Grade 2	Grade 3	Grade 4[b]
Softwoods:					
White pine	145.5	1.0	5.7	78.4	60.4
Red pine	20.9	--	--	15.7	5.2
Pitch pines	23.2	--	1.5	21.7	--
Other softwoods[c]	6.6	--	--	--	--
Total softwoods	196.2	1.0	7.2	115.8	65.6
Hardwoods:					
Select white oaks	60.3	--	7.2	39.4	13.7
Select red oaks	52.8	3.1	3.6	35.7	10.4
Other red oaks	135.9	10.0	18.4	84.5	23.0
Hickory	4.4	1.7	1.3	.4	1.0
Soft maples	73.2	--	9.2	32.8	31.2
Yellow birch	8.4	1.1	1.5	5.3	.5
Other softwoods	17.1	2.1	.7	12.3	2.0
Total hardwoods	352.1	18.0	41.9	210.4	81.8
	(In percent)				
Hardwood quality	100	5	12	60	23

[a] International 1/4-inch rule.

[b] Grade 4 applies only to the pines. For hardwoods the volumes in this column are for construction logs.

[c] Species other than pine are not graded into standard-lumber grades.

Table 16.--Annual net growth, removals[a] and mortality of growing stock and sawtimber on commercial forest land, by species, Rhode Island, 1971

Species	Growing stock			Sawtimber		
	Annual net growth	Annual timber removals	Annual mortality	Annual net growth	Annual timber removals	Annual mortality
	- - - - Thousand cubic feet - - - -			- - - - Thousand board feet[b] - - - -		
Softwoods:						
White pine	3,912	278	--	11,379	530	100
Red pine	940	60	--	1,653	77	--
Pitch pine	904	52	--	1,838	75	--
Other softwoods	244	10	--	530	18	--
Total softwoods	6,000	400	--	15,400	700	100
Hardwoods:						
Select white oaks	1,712	54	87	1,853	170	133
Select red oaks	2,010	917	87	3,459	1,637	372
Other red oaks [c]	3,635	934	117	8,510	3,475	60
Hickory	-196	311	34	474	500	--
Soft maples	2,044	240	418	2,527	867	161
Yellow birch	180	18	61	315	56	--
Other hardwoods	-485	426	496	762	595	174
Total hardwoods	8,900	2,900	1,300	17,900	7,300	900
Total, all species	14,900	3,300	1,300	33,300	8,000	1,000

[a] Data for timber removals in this table are based on the trend from 1952 through 1971.

[b] International 1/4-inch rule.

[c] Includes negligible amounts of other white oaks.

Table 17.--Annual net growth and removals of growing stock and sawtimber on commercial forest land, by ownership classes, softwoods and hardwoods, Rhode Island, 1971

Ownership	Annual net growth			Annual timber removals		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
			GROWING STOCK Thousand cubic feet			
Public	728	241	487	175	16	159
Farmer and other	14,172	5,759	8,413	3,125	384	2,741
All ownerships	14,900	6,000	8,900	3,300	400	2,900
			SAWTIMBER Thousand board feet[a]			
Public	1,530	336	1,194	501	15	486
Farmer and other	31,770	15,064	16,706	7,499	685	6,814
All ownerships	33,300	15,400	17,900	8,000	700	7,300

a/ International 1/4-inch rule.

Table 18.--Annual mortality of growing stock and sawtimber on commercial forest land, by ownership classes, causes, softwoods and hardwoods, Rhode Island, 1971

Ownership and cause	Growing stock (thousand cubic feet)			Sawtimber (thousand board feet)[a]		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
BY OWNERSHIP CLASS						
Public	71	--	71	62	2	60
Farmer and other	1,229	--	1,229	938	98	840
All ownerships	1,300	--	1,300	1,000	100	900
BY CAUSE						
Disease	875	--	875	777	100	677
Weather	130	--	130	223	--	223
Suppression	20	--	20	--	--	--
Unknown	275	--	275	--	--	--
All causes	1,300	--	1,300	1,000	100	900

a/ International 1/4-inch rule.

Table 19.--Components of average annual net growth of growing stock and sawtimber on commercial forest land, softwoods and hardwoods, Rhode Island, 1952-71

Components	All species	Softwoods	Hardwoods
	GROWING STOCK Thousand cubic feet		
Growth on initial growing-stock inventory a/	5,575	1,166	4,409
Ingrowth--saplings that became poletimber	9,699	2,344	7,355
Gross growth	15,274	3,510	11,764
Cull increment	2,194	142	2,052
Annual mortality	980	68	912
Average annual net growth	12,100	3,300	8,800
	SAWTIMBER Thousand board feet[b/]		
Growth on initial sawtimber inventory a/	6,716	1,741	4,975
Ingrowth--poletimber trees that became sawtimber	18,282	6,918	11,364
Gross growth	24,998	8,659	16,339
Cull increment	598	59	539
Annual mortality	900	200	700
Average annual net growth	23,500	8,400	15,100

a/ Including growth on trees that were cut.

b/ International 1/4-inch rule.

Table 20.--Sampling errors for major forest area and timber-volume classes in Rhode Island, 1972

Table No.	Item classification	Sampling error
	FOREST AREA	
		Percent
1	Forest-land area:	
	Commercial	3.1
	Total	3.0
2	Ownership:	
	Farmer owned	**
	Misc. private	6
	Farmer and misc. private	6
3	Stand-size class:	
	Sawtimber stands	21
	Poletimber stands	17
	Sapling-seedling stands	13
	Nonstocked areas	**
3	Stand-volume per acre (board feet):	
	Less than 1,500	9
	1,500 to 5,000	21
	More than 5,000	47
5	Growth-per-acre class (cubic feet):	
	120 to 165	*
	85 to 120	40
	50 to 85	19
	Less than 50	11
5	Area-condition class:	
	Class 50	24
	Class 60	10
	Class 70	29
6	Forest type:	
	White and red pine	44
	Pitch pine-eastern redcedar	48
	Oak-pine	39
	Oak-hickory	14
	Elm-ash-red maple	21
	Maple-beech-birch	*
	Aspen-birch	**

Table No.	Item classification	Sampling error
	TIMBER VOLUME	
		Cubic feet
		Percent
11	Class of timber:	
	Sawtimber trees	9
	Poletimber trees	8
	All growing stock	5.1
	Rough trees	14
	Rotten trees	19
	All live trees	5
12	Ownership:	
	Other public	49
	Farmer and other	6
12	Stand-size class:	
	Sawtimber stands	19
	Poletimber stands	17
	Sapling-seedling	22
	Nonstocked areas	**
12	Forest type:	
	White and red pine	42
	Pitch pine-eastern redcedar	*
	Oak-pine	*
	Oak-hickory	17
	Elm-ash-red maple	25
	Maple-beech-birch	*
	Aspen-birch	*
13-14	Diameter classes (inches):	
	5.0- 6.9	11
	7.0- 8.9	11
	9.0-10.9 a/	10
	11.0-12.9	12
	13.0-14.9	12
	15.0-16.9	18
	17.0-18.9	20
	19.0-20.9	36
	21.0-28.9	27
	29.0 and larger	*

Continu

Table 20.--Continued

Table No.	Item classification	Sampling error	
		Cubic feet	Board feet
		Percent	
4	Species:		
	White pine	29	28
	Red pine	*	*
	Pitch pine	43	*
	Other softwoods	*	*
	All softwoods	26	24
	Select white oaks	19	27
	Select red oaks	20	35
	Other oaks	15	21
	Hickory	47	*
	Soft maples	23	34
	Yellow birch	47	*
	Other hardwoods	34	34
	All hardwoods	9	16
	All species	5.1	9.9
	GROWTH-REMOVAL		
		Cubic feet	Board feet
		Percent	
	Growth by:		
17	Softwoods	39	49
	Hardwoods	12	17
	All species	12	21
17	Removals by:		
	Softwoods	*	*
	Hardwoods	36	*
	All species	33	*
	MORTALITY		
18	By species group:		
	Softwoods	*	**
	Hardwoods	24	*
	All species	23	45
18	By cause:		
	Weather	*	*
	Suppression	**	--
	Disease	22	*
	Unknown	*	--

* Sampling errors of 50 to 99 percent.

** Sampling errors of 100 or more.

a/ Board-foot sampling error for this class is for softwoods only.

Table 21.--Output of timber products, by source of material, softwoods and hardwoods, Rhode Island, 1971

Product and species group	Standard units	Total output		Output from roundwood		Output from plant byproducts	
		Number of units	Thousand cubic feet	Number of units	Thousand cubic feet	Number of units	Thousand cubic feet
Sawlogs:							
Softwood	M bd. ft.[a]	964	162	964	162	--	--
Hardwood	M bd. ft.[a]	2,655	445	2,655	445	--	--
Total	M bd. ft.[a]	3,619	607	3,619	607	--	--
Pulpwood:							
Softwood	Std. cords[b]	1,983	169	1,783	152	200	17
Hardwood	Std. cords[b]	6,409	545	4,955	421	1,454	124
Total	Std. cords[b]	8,392	714	6,738	573	1,654	141
Piling:							
Softwood	M linear ft.	--	--	--	--	--	--
Hardwood	M linear ft.	6	2	6	2	--	--
Total	M linear ft.	6	2	6	2	--	--
Posts (round and split):							
Softwood	M pieces	1	2	1	2	--	--
Hardwood	M pieces	--	--	--	--	--	--
Total	M pieces	1	2	1	2	--	--
Other:[c]							
Softwood	M cu. ft.	22	22	4	4	18	18
Hardwood	M cu. ft.	33	33	11	11	22	22
Total	M cu. ft.	55	55	15	15	40	40

Total industrial products:							
Softwood	M cu. ft.		355		320		35
Hardwood	M cu. ft.		1,025		879		146
Total	M cu. ft.		1,380		1,199		181
Fuelwood:							
Softwood	Std. cords	1,080	87	747	60	333	27
Hardwood	Std. cords	10,910	873	10,474	838	436	35
Total	Std. cords	11,990	960	11,221	898	769	62
All products:[d]							
Softwood	M cu. ft.		442		380		62
Hardwood	M cu. ft.		1,898		1,717		181
Total	M cu. ft.		2,340		2,097		243[e]

[a] International 1/4-inch rule.

[b] Rough wood basis, includes chips converted to equivalent standard cords.

[c] Includes dimension bolts, charcoalwood, and specialty items.

[d] Does not include 40,200 cubic feet of softwood and 8,800 cubic feet of hardwood residues used for agricultural bedding.

[e] Hardwood pulpwood from plant residues does not agree with Table 22 in Resource Bulletin NE-30, Primary Wood-Product Industries of Southern New England, 1971, because of different data sources.

Table 22.--Output of roundwood products, by source, softwoods and hardwoods, Rhode Island, 1971

(In thousands of cubic feet)

Product and species group	All sources	Growing-stock trees[a/]			Rough and rotten trees a/	Salvable dead trees a/	Other sources[b/]
		Total	Sawtimber	Poletimber			
PRINCIPAL INDUSTRIAL PRODUCTS							
Sawlogs:							
Softwood	162	141	136	5	--	1	20
Hardwood	445	427	406	21	2	--	16
Total	607	568	542	26	2	1	36
Pulpwood:							
Softwood	152	130	54	76	1	1	20
Hardwood	421	239	--	239	--	--	182
Total	573	369	54	315	1	1	202
MISCELLANEOUS INDUSTRIAL PRODUCTS							
Piling:							
Softwood	--	--	--	--	--	--	--
Hardwood	2	2	2	--	--	--	--
Total	2	2	2	--	--	--	--
Posts (round and split):							
Softwood	2	1	--	1	--	1	--
Hardwood	--	--	--	--	--	--	--
Total	2	1	--	1	--	1	--
Other:							
Softwood	4	2	--	2	--	2	--
Hardwood	11	7	5	2	2	--	2

Softwood	320	274	190	84	1	5	40
Hardwood	879	675	413	262	4	--	200
Total	1,199	949	603	346	5	5	240
			NONINDUSTRIAL PRODUCTS				
Fuelwood:							
Softwood	60	22	--	22	--	34	4
Hardwood	838	550	359	191	144	29	115
Total	898	572	359	213	144	63	119
			ALL PRODUCTS				
Softwood	380	296	190	106	1	39	44
Hardwood	1,717	1,225	772	453	148	29	315
Total	2,097	1,521	962	559	149	68	359

a/ On commercial forest land.

b/ Includes trees less than 5.0 inches in diameter, tree tops and limbs from commercial forest areas, or any material from noncommercial forest land or nonforest land such as fence rows and suburban areas.

Table 23.--Timber removals from growing stock and sawtimber on commercial forest land, by items, softwoods and hardwoods, Rhode Island, 1971

Item	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Thousand cubic feet			Thousand board feet[a]		
Roundwood products:						
Sawlogs	568	141	427	2,449	618	1,831
Pulpwood	369	130	239	197	197	--
Piling	2	--	2	9	--	9
Posts	1	1	--	--	--	--
Other	9	2	7	22	--	22
Fuelwood	572	22	550	1,616	--	1,616
All products	1,521	296	1,225	4,293	815	3,478
Logging residues	246	29	217	113	23	90
Other removals	1,736	88	1,648	2,450	54	2,396
Total removals	3,503	413	3,090	6,856	892	5,964

a/ International 1/4-inch rule.

Table 24.--Volume of unused residues at sawmills,[a] by type of residue for softwoods and hardwoods, Rhode Island, 1971

(In thousands of cubic feet)

Type of residue	Softwoods	Hardwoods	All species
Coarse[b]	10.3	23.5	33.8
Fine[c]	6.8	1.1	7.9
Total	17.1	24.6	41.7

a/ The sawmill industry was the only industry in Rhode Island with unused residues.

b/ Material, such as slabs and edgings.

c/ Material, such as sawdust and shavings.

Table 25.--Area by land classes and counties, Rhode Island, 1972

County	Total land area[a]	Non-forest area	Forest-land area: Non-commercial[b]	Forest-land area: Commercial	Forest-land area: Sampling error [c]
	Thousand acres				Percent
Bristol	15.9	11.0	0.5	4.4	45
Kent	110.4	38.5	1.0	70.9	7
Newport	73.6	45.9	--	27.7	14
Providence	265.9	104.7	4.4	156.8	5
Washington	205.6	67.1	3.0	135.5	6
Total	671.4	267.2	8.9	395.3	3

[a] Source: Areas of Rhode Island: 1960, Area Measurement Report, Bureau of the Census.

[b] Includes productive-reserved forest land only.

[c] In percent for commercial forest land, at the 68 percent probability level.

Table 26.--Area of commercial forest land, by ownership classes and counties, Rhode Island, 1972

(In thousands of acres)

County	Public-owned: State	Public-owned: County and municipal	Private-owned: Farmer-owned	Private-owned: Other private	Total
Bristol	--	0.1	0.4	3.9	4.4
Kent	--	1.4	2.4	67.1	70.9
Newport	--	.2	1.2	26.3	27.7
Providence	12.0	6.6	11.2	127.0	156.8
Washington	--	11.8	9.4	114.3	135.5
Total	12.0	20.1	24.6	338.6	395.3

Table 27.--Area of commercial forest land, by stand-size classes and counties, Rhode Island, 1972

(In thousands of acres)

County	Sawtimber stands	Poletimber stands	Sapling-seedling stands	Non-stocked areas	Total
Bristol	1.1	1.1	2.1	0.1	4.4
Kent	15.1	23.8	31.0	1.0	70.9
Newport	4.6	7.8	14.3	1.0	27.7
Providence	37.9	59.1	58.0	1.8	156.8
Washington	29.2	41.2	62.9	2.2	135.5
Total	87.9	133.0	168.3	6.1	395.3

Table 28.--Area of commercial forest land, by forest types and counties, Rhode Island, 1972

(In thousands of acres)

County	White and red pine	Pitch pine-eastern redcedar	Oak-pine	Oak-hickory	Elm-ash-red maple	Maple-beech-birch	Aspen-birch	Total
Bristol	0.3	0.5	0.4	1.7	1.3	0.1	0.1	4.4
Kent	5.5	4.6	6.5	30.4	20.4	2.4	1.1	70.9
Newport	1.5	2.3	3.8	10.9	7.7	.5	1.0	27.7
Providence	12.2	8.6	13.8	73.2	42.5	4.8	1.7	156.8
Washington	9.3	9.2	12.6	56.7	40.7	4.8	2.2	135.5
Total	28.8	25.2	37.1	172.9	112.6	12.6	6.1	395.3

Table 29.--Net volume of growing stock and sawtimber on commercial forest land, by stand-size classes and counties, Rhode Island, 1972

County	Sawtimber stands	Poletimber stands	Other stands	Total	Sampling error of total
	------------	Million cubic feet	--------------		Percent
Bristol	1.6	1.1	0.8	3.5	40
Kent	21.9	26.8	13.0	61.7	15
Newport	6.9	8.5	4.9	20.3	25
Providence	55.9	66.7	25.6	148.2	9
Washington	42.0	45.3	26.2	113.5	11
Total	128.3	148.4	70.5	347.2	5
	------------	Million board feet	--------------		Percent
Bristol	3.7	1.0	1.2	5.9	*
Kent	51.2	26.0	20.1	97.3	28
Newport	16.1	8.9	7.2	32.2	*
Providence	130.7	64.9	37.2	232.8	18
Washington	98.3	40.5	41.3	180.1	20
Total	300.0	141.3	107.0	548.3	10

a/ International 1/4-inch rule.

Table 30.--Net volume of growing stock and sawtimber on commercial forest land, by forest types and counties, Rhode Island, 1972

County	White and red pine	Pitch pine-eastern redcedar	Oak-pine	Oak-hickory	Elm-ash-red maple	Maple-beech birch	Aspen-birch	Total
				Million cubic feet				
Bristol	0.5	0.1	0.2	1.6	0.9	0.1	0.1	3.5
Kent	10.0	1.9	4.0	27.2	16.5	1.8	.3	61.7
Newport	3.0	.5	2.0	8.9	5.1	.5	.3	20.3
Providence	22.6	3.1	10.3	70.0	37.3	4.3	.6	148.2
Washington	16.2	4.0	7.3	49.4	32.3	3.6	.7	113.5
Total	52.3	9.6	23.8	157.1	92.1	10.3	2.0	347.2
				Million board feet[a]				
Bristol	1.5	0.1	0.5	2.2	1.4	0.1	0.1	5.9
Kent	25.6	2.2	8.2	34.2	24.8	1.4	.9	97.3
Newport	7.5	.3	3.8	11.8	7.6	.3	.9	32.2
Providence	59.0	3.5	20.4	89.1	56.5	2.6	1.7	232.8
Washington	44.3	4.7	15.4	62.8	48.3	2.7	1.9	180.1
Total	137.9	10.8	48.3	200.1	138.6	7.1	5.5	548.3

a/ International 1/4-inch rule.

Table 31.--Net volume of growing stock on commercial forest land, by species, tree classes, and counties, Rhode Island, 1972

(In millions of cubic feet)

County	Bristol	Kent	Newport	Providence	Washington	Total
			BY SPECIES			
White pine	0.5	9.0	3.2	20.3	15.7	48.7
Red pine	.2	2.0	.7	5.1	3.8	11.8
Pitch pine	.1	2.1	.7	4.2	4.3	11.4
Other softwoods	a/	.6	.2	1.1	1.2	3.1
Total softwoods	.8	13.7	4.8	30.7	25.0	75.0
Select white oaks	.5	8.6	2.8	22.0	16.2	50.1
Select red oaks	.4	8.6	2.8	23.2	14.9	49.9
Other oaks	.8	15.8	4.9	37.5	28.8	87.8
Hickory	a/	.6	.3	1.6	1.2	3.7
Soft maples	.7	10.9	3.6	24.8	21.4	61.4
Yellow birch	.1	1.3	.3	3.2	2.1	7.0
Other hardwoods	.2	2.2	.8	5.2	3.9	12.3
Total hardwoods	2.7	48.0	15.5	117.5	88.5	272.2
All species	3.5	61.7	20.3	148.2	113.5	347.2
			BY TREE CLASSES			
Sawtimber	1.6	26.2	8.6	62.9	48.7	148.0
Poletimber	1.9	35.5	11.7	85.3	64.8	199.2
All classes	3.5	61.7	20.3	148.2	113.5	347.2

a/ Less than 50,000 cubic feet.

Table 32.--Net volume of sawtimber on commercial forest land, by species and counties, Rhode Island, 1972

(In millions of board feet)[a]

Species	Bristol	Kent	Newport	Providence	Washington	Total
White pine	1.5	26.7	9.8	60.4	47.1	145.5
Red pine	.3	3.5	1.1	9.2	6.8	20.9
Pitch pine	.2	4.2	1.0	9.2	8.6	23.2
Other softwoods	.1	1.3	.3	2.4	2.5	6.6
Total softwoods	2.1	35.7	12.2	81.2	65.0	196.2
Select white oaks	.6	10.3	3.2	26.9	19.3	60.3
Select red oaks	.6	9.4	2.9	23.5	16.4	52.8
Other oaks	1.4	24.0	7.9	57.7	44.9	135.9
Hickory	.1	.8	.2	1.9	1.4	4.4
Soft maples	.9	12.7	4.2	30.6	24.8	73.2
Yellow birch	.1	1.4	.5	3.7	2.7	8.4
Other hardwoods	.1	3.0	1.1	7.3	5.6	17.1
Total hardwoods	3.8	61.6	20.0	151.6	115.1	352.1
All species	5.9	97.3	32.2	232.8	180.1	548.3

a/ International 1/4-inch rule.

☆U.S. GOVERNMENT PRINTING OFFICE: 1977-703-078/12

Peters, John R., and Teresa M. Bowers.
1977. **Forest statistics for Rhode Island.** Northeast. For. Exp. Stn., Upper Darby, Pa.
38 p. (USDA For. Serv. Resour. Bull. NE-49)

A report on the second inventory of the forest resources of Rhode Island, including trends of change in commercial forest-land acreage, volume of growing stock, and sawtimber volume. The report contains 32 tables of statistical data on forest land; timber volume; annual growth, removals, and mortality; and output of timber products.

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THE TIMBER INDUSTRIES OF KENTUCKY

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Headquarters of the Northeastern Forest Experiment Station are in Upper Darby, Pa. Field laboratories and research units are maintained at:

- Amherst, Massachusetts, in cooperation with the University of Massachusetts.
- Beltsville, Maryland.
- Berea, Kentucky, in cooperation with Berea College.
- Burlington, Vermont, in cooperation with the University of Vermont.
- Delaware, Ohio.
- Durham, New Hampshire, in cooperation with the University of New Hampshire.
- Hamden, Connecticut, in cooperation with Yale University.
- Kingston, Pennsylvania.
- Morgantown, West Virginia, in cooperation with West Virginia University, Morgantown.
- Orono, Maine, in cooperation with the University of Maine, Orono.
- Parsons, West Virginia.
- Pennington, New Jersey.
- Princeton, West Virginia.
- Syracuse, New York, in cooperation with the State University of New York College of Environmental Sciences and Forestry at Syracuse University, Syracuse.
- Warren, Pennsylvania.

HIGHLIGHTS

THE 1974 TIMBER-INDUSTRY SURVEY in Kentucky showed that, since 1969:

★ Total timber output has increased 1 percent to 98.1 million cubic feet.

★ Sawlog production has declined less than ½ percent to 489 million board feet.

★ Pulpwood production has increased 69 percent to 133 thousand cords.

★ Veneer-log production has declined 10 percent to 6.3 million board feet.

★ Cooperage-log production has declined 43 percent to 12.2 million board feet.

★ The number of sawmills has declined from 538 to 388.

ROUND TIMBER CONVERSIONS FOR MAJOR PRODUCTS:

Softwood logs: M bf (Int. 1/4-inch) = 178.7 ft^3 = 5.06 M^3
Hardwood logs: M bf (Int. 1/4-inch) = 146.0 ft^3 = 4.13 M^3
Pulpwood: 1 Std. Cord = 85 ft^3 = 2.41 M^3

BACKGROUND

THE FOREST SERVICE of the U.S. Department of Agriculture conducts continuing forest surveys of all states to provide up-to-date information about the timber and other related resources of the Nation. In the 14-state region served by the Northeastern Forest Experiment Station, all states have now been surveyed at least twice. Kentucky has now been inventoried for the third time. A part of the latest survey included a timber-industry survey to determine the output of timber products and the volume and disposition of primary wood-product manufacturing residues.

This report is the result of a 100-percent canvass of all primary wood-product manufacturers that were operating in Kentucky in 1974. Pulpwood production data were gathered as part of the Station's annual survey of pulpwood producers in the Northeast. The primary manufacturers were first contacted through a questionnaire that was mailed from the Experiment Station headquarters. After three mailings, those mill owners who did not respond were contacted in person by Kentucky Division of Forestry personnel. The authors thank the Kentucky primary wood-product manufacturers for their excellent cooperation and the personnel of the Kentucky Division of Forestry for assistance in contacting nonrespondents.

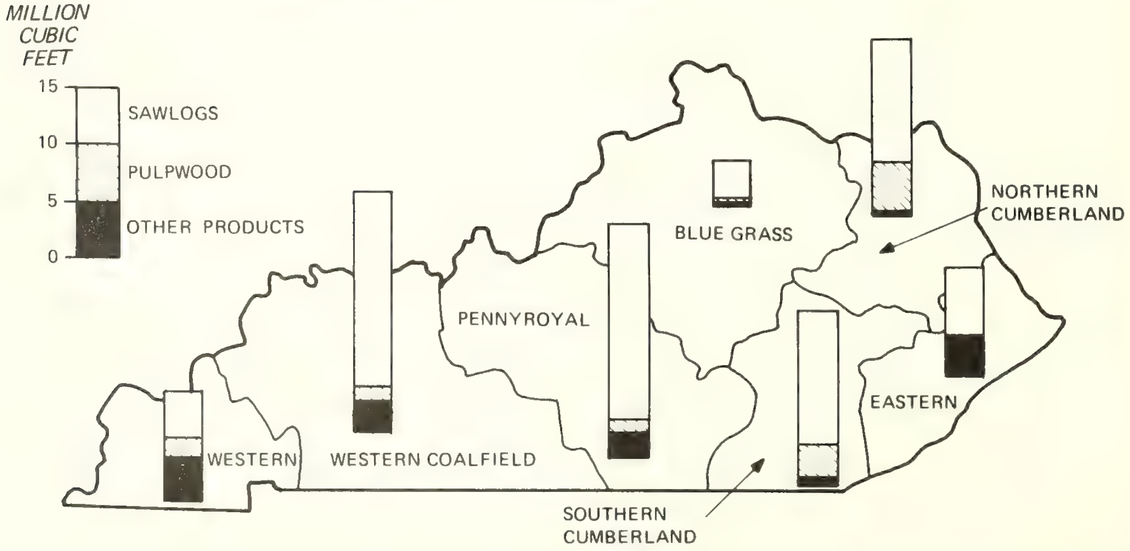
This report for the most part deals with statistics for two years: 1974, the calendar year of the current timber-industry survey; and 1969, the calendar year of the previous complete canvass. The reader is reminded that these years may, or may not, be representative for the various Kentucky timber industries covered in this report. When documented production statistics were available for individual timber products for previous or intervening years, they were included for comparative purposes.

Long-term production trends will be forthcoming from repeated surveys in the future. Until a data base is built up over time, the reader is cautioned to use the current statistics prudently.

INDUSTRIAL TIMBER HARVEST

Forest industries used more than 98 million cubic feet of timber from the forests of Kentucky in 1974. Ninety percent of this volume was from hardwoods. Sawlogs were the major timber product, accounting for nearly three-fourths of the total harvest. Pulpwood ranked second in volume, accounting for about 12 percent of the total. Other products that made up a minor portion of the harvest were veneer and cooperage logs, mine timbers, posts and poles,

Figure 1.—Harvest of industrial timber in Kentucky, by geographic regions and major products, 1974.



metallurgical and charcoal wood, and handle stock.

Overall, the timber harvest in Kentucky has increased 1 percent since 1969, when the last industry survey was made, and 8 percent since 1962. Though the sawlog harvest has remained virtually the same since 1969, the pulpwood harvest has jumped 69 percent. This dramatic increase occurred because three pulpmills have been established within the State since 1967. The most recent mill, which produces 600 tons of woodpulp per day, has been responsible for nearly doubling Kentucky's pulpwood requirement since 1970.

The harvest of roundwood for veneer and cooperage logs and for the other minor products decreased between 1969 and 1974. Cooperage-log production dropped 43 percent during the period because the distilling industry has been re-using wooden barrels. The softwood harvest has remained the same during the 5-year period, while the hardwood harvest has increased 1 percent.

Kentucky's west-central regions—the Pennyroyal and Western Coalfield Regions—produced 43 percent of the State's industrial roundwood in 1974 (fig. 1). The 21.3 million-cubic-foot hardwood harvest in the Western Coalfield Region and 4.8 million-cubic-foot softwood harvest in the South Cumberland Region were records for the respective species groups. The largest volume of sawlogs came from the Western Coalfields, and the largest volume of pulpwood came from the North Cumberland Region in 1974. The Western Region had the largest harvest of other minor products, accounting for 27 percent of the total. Harlan, McCreary, and Ohio Counties each produced more than 15 million board feet of sawlogs in 1974.

LUMBER AND SAWLOGS

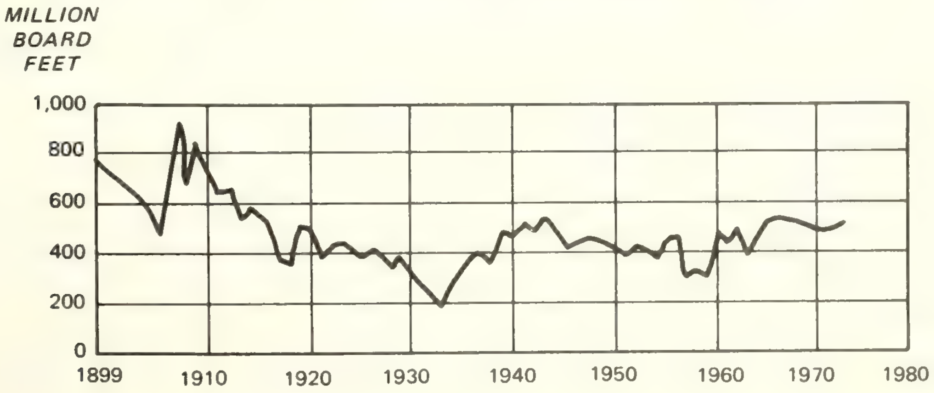
Kentucky has been an important hardwood lumber-producing state for a century. The 200 million board feet of hardwood lumber produced in 1869 ranked the State seventh in the Nation. In 1973, the State ranked fourth behind Virginia, Tennessee, and Pennsylvania.

Annual lumber production has ranged from 913 million board feet in 1907 to 180 million board feet in 1933 (fig. 2). During World War II, lumber production climbed from the lows of the depression years to more than 500 million board feet. Since the war, production has declined. Estimated production for Kentucky was 468 million board feet in 1974.

The number of sawmills operating in Kentucky has generally followed the fluctuations in lumber production. During the first decade of the century, when historic high production levels were being recorded, more sawmills were operating in Kentucky than at any other time: 2,351 sawmills operated in 1909. By 1918, the number of mills had dropped to 464. An all-time low of 104 sawmills was reported in 1933. During World War II the number increased—to 1,875 in 1942; and to 2,168 by 1947.

Our industry study showed that the number of sawmills decreased from 538 in 1969 to 388 in 1974. This change is inconsistent with long-term trends because the 28-percent decrease in the number of sawmills was accompanied by an 8-percent decrease in lumber production. However, the change is consistent with the trend toward larger production units that has

Figure 2.—Lumber production in Kentucky, 1899-1972.



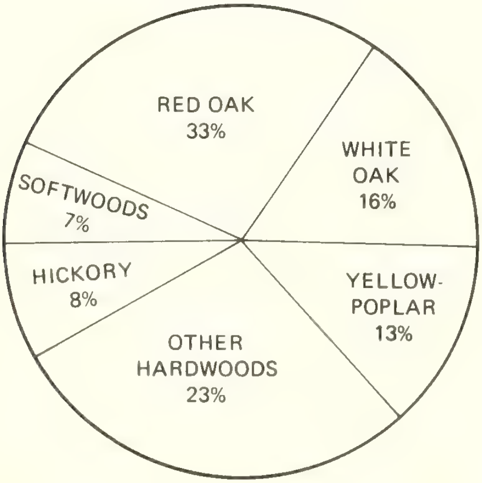
developed in all of the eastern states during the last quarter century. Most of the sawmills that closed between 1969 and 1974 were low-production mills capable of producing less than a million board feet annually. The Bluegrass Region experienced the greatest percentage loss of mills (55 percent) and the Pennyroyal Region experienced the greatest numerical loss (48 sawmills).

Although sawlog production and receipts have remained virtually the same for the past 5 years in Kentucky, some significant shifts have taken place between regions. Sawlog production declined 29 percent in the Eastern Region and 12 percent in the Western Coalfields between 1969 and 1974. Concurrently, production climbed 29 percent in the North Cumberland Region and 16 percent in the Pennyroyal Region.

Sawlog receipts declined 37 and 15 percent respectively in the Eastern and Western Regions. At the same time, receipts rose 27 and 16 percent respectively in the Pennyroyal and North Cumberland Regions. In the Western Region, sawlog production rose 5 percent, but receipts fell 15 percent; while in the Bluegrass Region production fell 6 percent and receipts rose 13 percent.

Statewide, Kentucky was a net importer of sawlogs in 1974. Some 27 million board feet of the 489 million board-foot sawlog harvest was shipped to other states for manufacture. Kentucky sawmills imported nearly 35 million board feet of sawlogs from other states, in addition to the 462 million board feet they obtained from Kentucky forest lands. Tennessee was both the largest recipient of Kentucky sawlogs and the largest supplier of sawlogs to Kentucky sawmills in 1974. Indiana ranked second.

Figure 3.—Kentucky sawlog production, by species, in percent, 1974.



Since oaks make up 44 percent of the growing-stock volume, it is to be expected that sawlog production was dominated by the oaks in 1974. Red oaks accounted for 33 percent of the volume of sawlogs produced, and white oaks accounted for 16 percent (fig. 3). Other important hardwood species included yellow-poplar, hickory, and maple. The softwood species accounted for only 7 percent of the total volume harvested. Shortleaf pine was the most important softwood harvested.

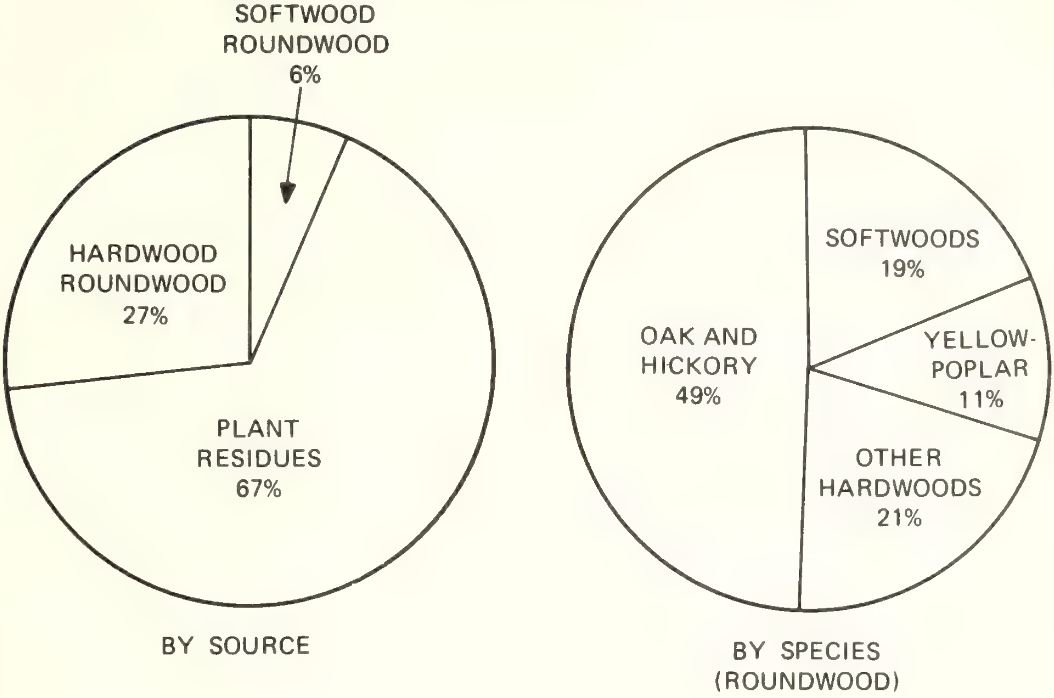
PULPWOOD

More than 133 thousand cords of pulpwood were harvested from Kentucky timberlands in 1974, and in addition, more than 263 thousand cord equivalents of pulp chips were recovered from the primary wood-product manufacturing plants of the State. Although the volume of wood from plant residues is at a record high level, the total roundwood harvest is down 73 thousand cords from 1973, when 206 thousand cords of roundwood was harvested. Six percent of the 1974 pulpwood production came from softwoods, 27 percent came from hardwoods, and 67 percent came from manufacturing residues (fig. 4). Most of the softwood harvest was pine. Oak and hickory represented 49 percent of the total roundwood harvest. Yellow-poplar made up 11 percent of the total.

Before April 1967, all of Kentucky's pulpwood production was exported to manufacturers in neighboring states. The 75-thousand-cord annual harvest was divided evenly between the hardwood pulpmills in Ohio and the pine pulpmills in Tennessee. Kentucky's first pulpmill at Hawesville had a negligible effect on pulpwood production because it used wood residues that were generated by local primary wood-product manufacturers (fig. 5).

Two years later, a second pulpmill was constructed at Hawesville, and in 1969 a new 600-

Figure 4.—Kentucky pulpwood production, in percent, 1974.



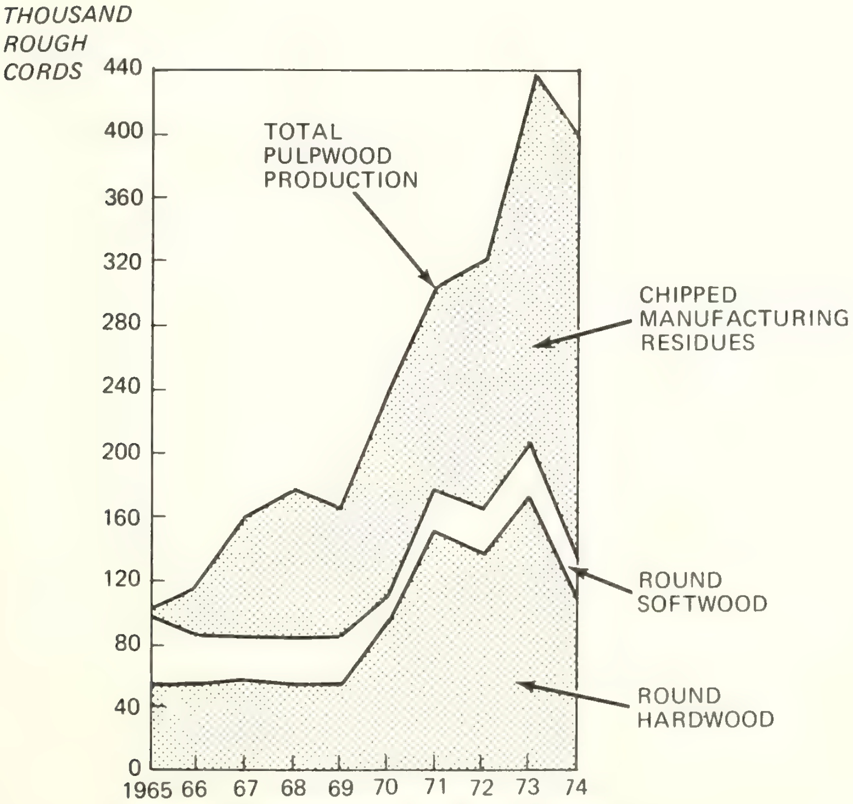


Figure 5.—Pulpwood production in Kentucky, by source, 1965-1974.

ton-per-day pine and hardwood kraft mill began to build a wood inventory at Wickliffe, Kentucky. The result of installing nearly 1,100 tons per day of woodpulp capacity in Kentucky in the last 5 years was to transform the State from a net exporter of pulpwood to the second largest importer of pulpwood in the Northeast in 1974. Although the pulpwood harvest increased 59 percent and chipped residue production increased 212 percent between 1969 and 1974, an additional 287 thousand cords of pulpwood was required in 1974 to meet the industry's demand for wood fiber. This pulpwood was imported from as far away as Mississippi and Alabama.

In the last decade, 285 thousand cords of softwood pulpwood from roundwood and 946 thousand cords of hardwood pulpwood from roundwood were harvested from Kentucky forest lands. Nearly 65 percent of the softwood came from the South Cumberland Region and nearly 38 percent of the hardwood came from the North Cumberland Region. Together the two Cumberland regions accounted for 61 percent of the pulpwood harvest in Kentucky between 1965 and 1974.

OTHER TIMBER PRODUCTS

Veneer Logs and Bolts

More than 6.3 million board feet of veneer logs were harvested in Kentucky in 1974. Sixty-three percent of the volume was shipped to 5 other states for manufacture. Indiana and Tennessee were major recipients. More cottonwood was shipped from the State than any other species, whereas black walnut and red oak were favored for retention by local manufacturers.

Kentucky veneer plants received more than 6.9 million board feet of veneer logs in 1974. Nearly two-thirds of these logs were imported from 15 other states. Oaks and black walnut were the major species imported. During the 1974 survey, no attempt was made to trace veneer logs that were not channeled through primary manufacturers. Therefore the volume statistics for some species might be low. They do not include veneer-log purchases by brokers for export overseas. About 7.8 million board feet of walnut logs were exported nationally in 1974. Undoubtedly many of these logs were harvested from Kentucky forest lands, since the State ranks second in the Nation in its volume of walnut growing stock.

Changing consumer preferences and the availability of suitable high-quality logs have affected the species distribution of the veneer-log harvest over the years. Important veneer species harvested from Kentucky forest lands during the last quarter century give an indication of these changing trends:

Year	*Species*	*Harvest (million bd. ft.)* [a]	*Portion of total harvest (percent)*
1948	White oak	1.4	14
	Yellow-poplar	1.1	12
	Sweetgum	1.1	11
	Black walnut	1.0	10
1968	Black walnut	2.6	31
	Cottonwood	1.3	15
	Hickory (pecan)	1.1	13
	Yellow-poplar	0.8	10
1974	Black walnut	1.7	26
	Cottonwood	1.3	20
	Yellow-poplar	0.8	12
	Red oak	0.8	12

[a] International 1/4-inch rule.

Species preferences for veneer logs were less pronounced in 1948 than in 1974. The four most important species harvested in 1948 made up only 47 percent of the total volume harvested. In 1974, four species accounted for 70 percent of the total. Black walnut has always been a major component of the harvest. White oak and sweetgum have been replaced recently by cottonwood and red oak.

Cooperage

Tight cooperage for bourbon barrels has been an important use of white oak in Kentucky for many years. However, large high-quality white oak sawtimber is becoming increasingly difficult to find.

Nationwide, production of new barrels dropped from 2.3 million in 1969 to 1.2 million in 1974. This drop in demand is mostly responsible for the number of stave mills in Kentucky dropping from 23 in 1969 to 12 in 1974. Cooperage-log receipts during the same period dropped from 20.8 million board feet to 13.4 million board feet. Cooperage-log production in Kentucky was 12.2

million board feet, a 43-percent decrease since 1969.

In 1948 there were 87 tight-stave and heading mills operating in Kentucky. Most of them were portable so they could shift from county to county to take advantage of local markets and available timber. These mills used nearly 39 million board feet of oak logs and bolts from Kentucky forest lands. The staves they produced brought a high price, but they required more labor per unit of production than any other timber product.

By 1958, the number of stave mills had dropped 78 percent (to 19 mills), and cooperage log production in Kentucky had been halved. Even so, the State was a major stave manufacturer. The 19.4 million board feet processed by Kentucky's 19 mills in 1958 represented more than 21 percent of the production total for the Central States, and 8 percent of the Nation's cooperage-log requirement.

In 1962 the tight-cooperage industry curtailed production temporarily while awaiting the outcome of a proposal to change the federal regulation that forbad the re-use of bourbon barrels. In 1970 the regulations was changed, allowing the re-use of bourbon barrels for the production of light whisky. The effects were immediate: a strong used-barrel market developed, and production of new barrels dropped significantly.

By 1972, however, even with heavy promotion, a strong market did not develop for light whisky, and distillers curtailed production. Many stave producers thought that the market for new barrels would pick up, but in 1974, cooperage production was still low. Local observers[1] give the following reasons for the continued decline in demand for bourbon barrels:

1. Bourbon sales in the United States declined 14 percent between 1969 and 1974; so less was bottled.
2. Bourbon warehouse inventories declined 25 percent between 1969 and 1974, therefore less whisky and fewer barrels were used to replenish inventories.
3. The bourbon barreled for storage in 1974 was about 120 proof; in 1969, most bourbon produced was 105 or 110 proof. Thus fewer barrels were required in 1974.
4. Currently, more 4-year-old bourbon is bottled and sold than a few years ago, when 6- to 8-year-old bourbon was popular.
5. Currently, the trend is to bottle and sell 80-proof whisky rather than the 86- and 100-proof whiskies that were popular a few years ago.

These and other factors will probably cause cooperage-log production to continue to decline in the future.

Miscellaneous

Kentucky has many small wood-using industries whose combined timber requirements from the forest lands of the State approached 11.7 million cubic feet in 1974.

Fourteen plants received handle logs in 1974. Some of these plants were producing furniture squares, pallet parts, and bat blanks in addition to handle blanks. About 7.4 million board feet of handle logs were harvested in Kentucky during the year. Comparisons for selected years can be made with the following statistics:

Year	*Plants (No.)*	*Production*	*Receipts*
		(million board feet) [a]	
1948	3	5.5	1.1
1962	9	4.3	3.8
1969	22	10.4	10.4
1974	14	7.4	7.3

[a] International 1/4-inch rule.

Most handle plants use ash and hickory; hickory is preferred for such striking tools as picks and hammers, whereas ash is preferred for pulling and lifting tools such as shovels and rakes.

Kentucky charcoal producers are finding manufacturing from round timber and solid wood residues difficult because of stringent air-pollution regulations. In 1974 they used less than a half million cubic feet of roundwood and 5.1 million cubic feet of plant residues at two plant locations, most of it from hardwoods. This compares with 4.2 million cubic feet of roundwood and 1.4 million cubic feet of plant residues that were consumed at five locations in 1969.

Coal mining, which is concentrated in eastern Kentucky, has depended upon local forests over the years as a source of mine props and shoring material. Some 5.3 million cubic feet of mine timbers were used in 1974. This is an 8-percent decrease from 1969, when 5.7 million cubic feet were produced.

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[1] Clayton, J. M., and J. A. Newman, 1976. Personal correspondence. WesCor Corp., Hawesville, Ky., and Coop. Ext. Ser., U. of Ky., Lexington, Ky. (On file at NE Forest Exp. Sta., Upper Darby, Pa.)

MANUFACTURING RESIDUES

The woodpulp industry in Kentucky has grown to depend upon primary manufacturing residues as a convenient, readily available, and environmentally acceptable source of raw material. More stringent air- and water-pollution laws in the State have discouraged wood-product manufacturers from burning or dumping their residues and have encouraged them to seek pulpmills and other markets for their waste material.

More than 49 million cubic feet of residues were generated by the primary wood-product manufacturers of Kentucky in 1974. Of this, 40 million cubic feet was woody material and 9 million cubic feet was bark. Some 25 million cubic feet of the woody residue was suitable for conversion into chips for fiber products. Sixty-five percent of all residues—32 million cubic feet—was used. Only 32 percent of the bark residue was used, but 73 percent of the wood residue was used.

When the results of our 1974 study in Kentucky were compared with a similar study *(Bones and Lohr 1972)* made in 1969, some important trends were identified (fig. 6).

- A 26-percent greater volume of the sawmill residue was being used in 1974 than in 1969.
- A 21-percent greater volume of sawmill residues was being used for fiber-product chips in 1974 than in 1969.
- A 5-percent greater volume of sawmill residues was being used for such products as livestock bedding, horticultural mulch, and flakeboard in 1974 than in 1969.

Figure 6.—Trends in sawmill residue use in Kentucky, in percent, 1969 and 1974.

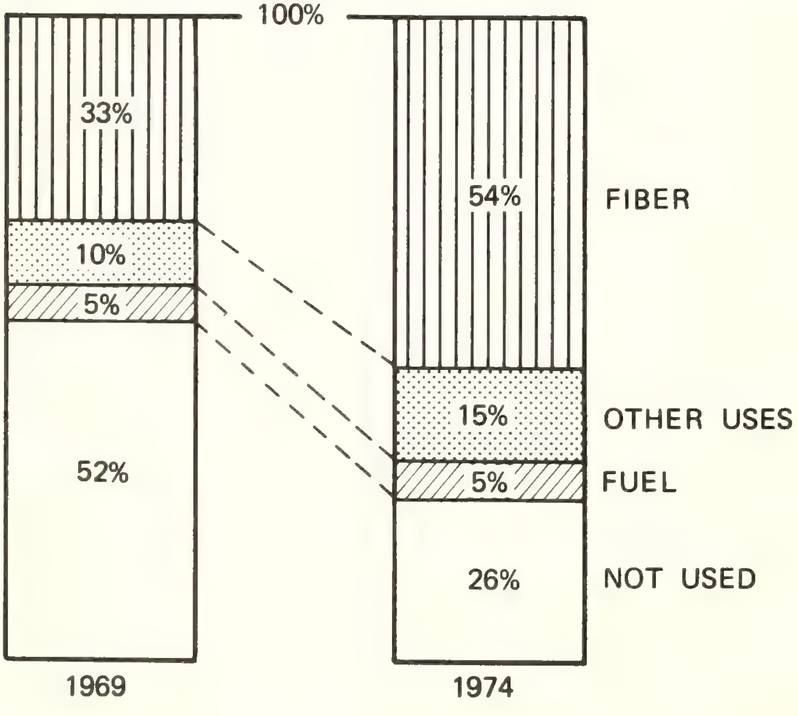

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Table 1.—Volume of industrial timber, by products harvested in Kentucky in 1974

Product	Volume in standard units				Roundwood volume		
	Standard units	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
					Thousand cubic feet		
Sawlogs	M board feet [a]	488,794	32,292	456,502	72,429	5,771	66,658
Pulpwood	Standard cords	133,100	24,800	108,300	11,313	2,108	9,205
Veneer logs	M board feet [a]	6,332	—	6,332	853	—	853
Cooperage logs	M board feet [a]	12,152	—	12,152	1,733	—	1,733
Mine timbers	M cubic feet	5,251	428	4,823	5,251	428	4,823
Posts	M pieces	744	10	734	1,598	21	1,577
Misc. products [b]	M cubic feet	4,890	1,778	3,112	4,890	1,778	3,112
Total	—	—	—	—	98,067	10,106	87,961

[a] International 1/4-inch log rule.

[b] Includes poles, handle stock, metallurgical wood, charcoal wood, dimension, and flakeboard chips.

Table 2.—Change in timber products output in Kentucky between 1969 and 1974

Product	All species			Softwoods			Hardwoods		
	1969	1974	Change	1969	1974	Change	1969	1974	Change
	Million cubic feet		*Percent*	*Million cubic feet*		*Percent*	*Million cubic feet*		*Percent*
Sawlogs	72.6	72.4	(a)	6.3	5.8	− 8	66.3	66.6	(a)
Pulpwood	6.7	11.3	+69	2.2	2.1	− 5	4.5	9.2	+104
Veneer logs	1.0	.9	−10	—	—	—	1.0	.9	− 10
Cooperage logs	3.0	1.7	−43	—	—	—	3.0	1.7	− 43
Mine timbers	5.7	5.3	− 8	.4	.4	+10	5.3	4.9	− 9
Misc. products b	7.9	6.5	−18	1.2	1.8	+50	6.7	4.7	− 30
Total	96.9	98.1	+ 1	10.1	10.1	(a)	86.8	88.0	+ 1

[a] Less than 0.5 percent.

[b] Includes posts, poles, handle stock, metallurgical wood, charcoal wood, and dimension.

Table 3.—Industrial timber harvest[a] in Kentucky, by geographic regions, species groups, and products, 1974

[In thousands of cubic feet]

Region and species group	Sawlogs	Pulpwood	Other products[b]	All products
Eastern:				
Softwood	322	—	257	579
Hardwood	6,468	—	2,905	9,373
Total	6,790	—	3,162	9,952
North Cumberland:				
Softwood	875	187	1	1,063
Hardwood	10,455	3,918	1,029	15,402
Total	11,330	4,105	1,030	16,465
South Cumberland:				
Softwood	3,127	1,615	76	4,818
Hardwood	8,922	1,020	1,258	11,200
Total	12,049	2,635	1,334	16,018
Bluegrass:				
Softwood	268	17	7	292
Hardwood	2,687	8	345	3,040
Total	2,955	25	352	3,332
Pennyroyal:				
Softwood	1,126	289	15	1,430
Hardwood	16,223	1,351	1,984	19,558
Total	17,349	1,640	1,999	20,988
Western Coalfield:				
Softwood	18	—	153	171
Hardwood	17,522	1,369	2,379	21,270
Total	17,540	1,369	2,532	21,441
Western:				
Softwood	35	—	1,718	1,753
Hardwood	4,381	1,539	2,198	8,118
Total	4,416	1,539	3,916	9,871
All regions:				
Softwood	5,771	2,108	2,227	10,106
Hardwood	66,658	9,205	12,098	87,961
Total	72,429	11,313	14,325	98,067

[a] Does not include fuelwood or removals that are not manufactured into industrial products.

[b] Includes mine timber, veneer and cooperage logs, poles and posts, handle stock, metallurgical wood, and charcoal wood.

Table 4.—Number of sawmills in Kentucky, by geographic regions and annual production classes, 1969 and 1974

Region	Production class [a]							
	Greater than 1 million board feet		Less than 1 million board feet		Idle and custom mills		Total	
	1969	1974	1969	1974	1969	1974	1969	1974
Eastern	13	6	16	7	17	19	46	32
North Cumberland	19	20	29	17	40	25	88	62
South Cumberland	20	22	37	17	17	24	74	63
Bluegrass	3	6	11	3	35	13	49	22
Pennyroyal	28	32	63	34	83	60	174	126
Western Coalfield	39	27	16	13	28	25	83	65
Western	9	8	9	6	6	4	24	18
All regions	131	121	181	97	226	170	538	388

[a] Based upon the volume of lumber produced during calendar years 1969 and 1974.

Table 5.—Sawlog production and receipts relationships in Kentucky, by geographic regions between 1969 and 1974

Region	Production			Receipts		
	1969	1974	Change	1969	1974	Change
	Million board feet [a]	*Million board feet* [a]	*Percent*	*Million board feet* [a]	*Million board feet* [a]	*Percent*
Eastern	64.8	46.1	- 29	62.6	39.4	- 37
North Cumberland	59.2	76.5	+29	67.0	77.6	+16
South Cumberland	77.4	78.6	+ 2	77.0	77.8	+ 1
Bluegrass	21.1	19.9	- 6	13.7	15.5	+13
Pennyroyal	101.1	117.4	+16	94.5	120.0	+27
Western Coalfield	136.7	120.1	- 12	152.6	142.9	- 6
Western	28.8	30.2	+ 5	27.4	23.3	- 15
All regions	489.1	488.8	(b)	494.8	496.5	(b)

[a] International 1/4-inch rule.

[b] Less than 0.5-percent change.

Table 6.—Sawlog production for Kentucky, by species groups, geographic regions, and where received, 1974

[In millions of board feet, International 1/4-inch rule]

Species group and geographic region	Where received			Total production
	Within region	Within state	In other states	
Softwoods:				
Eastern	1.4	0.4	—	1.8
North Cumberland	4.8	.1	—	4.9
South Cumberland	12.3	3.2	2.0	17.5
Bluegrass	.9	.6	—	1.5
Pennyroyal	5.7	.5	.1	6.3
Western Coalfield	—	(a)	.1	.1
Western	—	—	.2	.2
All regions	25.1	4.8	2.4	32.3
Hardwoods:				
Eastern	31.1	12.8	.4	44.3
North Cumberland	65.7	4.7	1.2	71.6
South Cumberland	41.8	13.4	5.9	61.1
Bluegrass	8.3	10.1	—	18.4
Pennyroyal	90.0	17.8	3.3	111.1
Western Coalfield	106.5	7.5	6.0	120.0
Western	16.2	6.0	7.8	30.0
All regions	359.6	72.3	24.6	456.5
All species	384.7	77.1	27.0	488.8

[a] Less than 50,000 board feet.

Table 7.—Sawlog receipts for Kentucky, by species groups, geographic regions, and where produced, 1974

[In millions of board feet, International 1/4-inch rule]

Species group and geographic region	Where produced			Total receipts
	Within region	Within state	In other states	
Softwoods:				
Eastern	1.4	0.1	(a)	1.5
North Cumberland	4.8	.6	—	5.4
South Cumberland	12.3	.6	(a)	12.9
Bluegrass	.9	.2	—	1.1
Pennyroyal	5.7	3.2	0.1	9.0
Western Coalfield	—	.1	—	.1
Western	—	—	—	—
All regions	25.1	4.8	0.1	30.0
Hardwoods:				
Eastern	31.1	5.2	1.6	37.9
North Cumberland	65.7	6.5	—	72.2
South Cumberland	41.8	16.3	6.8	64.9
Bluegrass	8.3	4.7	1.4	14.4
Pennyroyal	90.0	18.1	2.9	111.0
Western Coalfield	106.5	19.0	17.3	142.8
Western	16.2	2.6	4.5	23.3
All regions	359.6	72.4	34.5	466.5
All species	384.7	77.2	34.6	496.5

[a] Less than 50,000 board feet.

Table 8.—Sawlog production and receipts in the EASTERN REGION of Kentucky, by species and destination of shipments, 1974

[In millions of board feet, International 1/4-inch rule]

Species	Cut and retained in region	Out-shipments		Total production	In-shipments		Total receipts
		To other regions	To other states		From other regions	From other states	
Hemlock	0.7	0.1	—	0.8	0.1	(a)	0.8
Shortleaf pine	.6	.2	—	.8	(a)	(a)	.6
Other softwoods [b]	.1	.1	—	.2	—	—	.1
Total softwoods	1.4	0.4	—	1.8	0.1	(a)	1.5
Ash	0.4	0.4	(a)	0.8	0.1	(a)	0.5
Basswood	1.2	.3	(a)	1.5	.2	(a)	1.4
Beech	3.0	.9	(a)	3.9	.4	.2	3.6
Gum	.8	.4	—	1.2	.1	(a)	.9
Hickory	4.0	1.3	(a)	5.3	.5	.2	4.7
Hard maple	1.2	.4	(a)	1.6	.2	.1	1.5
Soft maple	.8	.3	—	1.1	.1	.1	1.0
Northern red oak	2.6	.2	—	2.8	.5	.2	3.3
Black oak	2.9	.3	.1	3.3	.6	.2	3.7
Other red oaks	3.1	2.4	.1	5.6	.4	.1	3.6
White oak	1.9	.8	.1	2.8	.4	.1	2.4
Chestnut oak	3.9	2.1	—	6.0	.7	.2	4.8
Yellow-poplar	4.5	2.5	.1	7.1	1.0	.2	5.7
Other hardwoods [c]	.8	.5	—	1.3	(a)	(a)	.8
Total hardwoods	31.1	12.8	0.4	44.3	5.2	1.6	37.9
All species	32.5	13.2	0.4	46.1	5.3	1.6	39.4

[a] Less than 50,000 board feet.

[b] Includes Virginia and other pines and eastern redcedar.

[c] Includes elm, other white oaks, sycamore, and black walnut.

Table 9.—Sawlog production and receipts in the NORTH CUMBERLAND REGION of Kentucky, by species and destination of shipments, 1974

[In millions of board feet, International 1/4-inch rule]

Species	Cut and retained in region	Out-shipments		Total production	In-shipments		Total receipts
		To other regions	To other states		From other regions	From other states	
Shortleaf pine	2.8	—	—	2.8	0.2	—	3.0
Virginia pine	.5	—	—	.5	.1	—	.6
Other softwoods [b]	1.5	0.1	—	1.6	.3	—	1.8
Total softwoods	4.8	0.1	—	4.9	0.6	—	5.4
Ash	1.5	(a)	0.1	1.6	0.3	—	1.8
Basswood	.8	(a)	(a)	.8	.1	—	.9
Beech	2.9	.1	(a)	3.0	.3	—	3.2
Gum	.5	(a)	—	.5	.1	—	.6
Hickory	4.9	.9	(a)	5.8	.5	—	5.4
Hard maple	.9	(a)	.1	1.0	.1	—	1.0
Soft maple	1.3	(a)	(a)	1.3	.3	—	1.6
Northern red oak	8.8	.1	.4	9.3	.5	—	9.3
Black oak	11.6	.4	.1	12.1	.8	—	12.4
Other red oaks	8.0	.6	.1	8.7	1.3	—	9.3
White oak	9.0	.3	.1	9.4	.8	—	9.8
Chestnut oak	6.2	.7	.2	7.1	.2	—	6.4
Yellow-poplar	7.8	1.1	.1	9.0	.9	—	8.7
Black walnut	.6	.3	(a)	.9	(a)	—	.6
Other hardwoods [c]	.9	.2	(a)	1.1	.3	—	1.2
Total hardwoods	65.7	4.7	1.2	71.6	6.5	—	72.2
All species	70.5	4.8	1.2	76.5	7.1	—	77.6

[a] Less than 50,000 board feet.

[b] Includes hemlock, eastern redcedar, and other pines.

[c] Includes cottonwood, elm, other white oaks, and sycamore.

Table 10.—Sawlog production and receipts in the SOUTH CUMBERLAND REGION of Kentucky, by species and destination of shipments, 1974

[In millions of board feet, International 1/4-inch rule]

Species	Cut and retained in region	Out-shipments		Total production	In-shipments		Total receipts
		To other regions	To other states		From other regions	From other states	
Hemlock	0.7	0.2	—	0.9	(a)	—	0.7
Shortleaf pine	10.5	1.8	—	12.3	0.4	(a)	10.9
Virginia pine	.8	(a)	2.0	2.8	.1	—	.9
Other softwoods [b]	.3	1.2	—	1.5	.1	—	.4
Total softwoods	12.3	3.2	2.0	17.5	0.6	(a)	12.9
Ash	0.7	0.2	(a)	0.9	0.4	0.1	1.2
Basswood	.5	.2	—	.7	.3	(a)	.8
Beech	2.7	.9	(a)	3.6	1.0	.5	4.2
Gum	1.1	.2	(a)	1.3	.5	.4	2.1
Hickory	3.5	1.0	.1	4.6	1.6	.7	5.8
Hard maple	.9	.4	.1	1.4	.4	.1	1.4
Soft maple	1.0	.3	—	1.3	.5	.1	1.6
Northern red oak	1.5	.6	.7	2.8	.2	1.0	2.7
Black oak	5.4	1.6	1.3	8.3	1.6	1.1	8.0
Other red oaks	6.3	1.6	1.3	9.2	3.0	—	9.3
White oak	4.1	1.1	.7	5.9	1.0	.7	5.8
Chestnut oak	4.2	1.4	1.3	6.9	1.8	1.3	7.3
Yellow-poplar	8.7	2.9	.3	11.9	3.6	.4	12.7
Other hardwoods [c]	1.2	1.0	.1	2.3	.4	.4	2.0
Total hardwoods	41.8	13.4	5.9	61.1	16.3	6.8	64.9
All species	54.1	16.6	7.9	78.6	16.9	6.8	77.8

[a] Less than 50,000 board feet.

[b] Includes other pines and eastern redcedar.

[c] Includes elm, other white oaks, sycamore, and black walnut.

Table 11.—Sawlog production and receipts in the BLUEGRASS REGION of Kentucky, by species and destination of shipments, 1974

[In millions of board feet, International 1/4-inch rule]

Species	Cut and retained in region	Out-shipments		Total production	In-shipments		Total receipts
		To other regions	To other states		From other regions	From other states	
Eastern redcedar	0.8	0.1	—	0.9	0.2	—	1.0
Other softwoods [b]	.1	.5	—	.6	(a)	—	.1
Total softwoods	0.9	0.6	—	1.5	0.2	—	1.1
Ash	0.1	0.8	—	0.9	—	(a)	0.1
Beech	.2	.9	—	1.1	(a)	0.3	.5
Hickory	.5	.7	—	1.2	.7	—	1.2
Hard maple	(a)	.4	—	.4	—	.1	.1
Northern red oak	1.0	.7	—	1.7	.3	—	1.3
Black oak	1.1	1.0	—	2.1	.5	—	1.6
Other red oak	.9	1.9	—	2.8	.7	(a)	1.6
White oak	.9	.9	—	1.8	.4	(a)	1.3
Chestnut oak	.5	.3	—	.8	.2	—	.7
Yellow-poplar	1.1	1.8	—	2.9	1.0	.1	2.2
Black walnut	1.8	.1	—	1.9	.7	.9	3.4
Other hardwoods [c]	.2	.6	—	.8	.2	(a)	.4
Total hardwoods	8.3	10.1	—	18.4	4.7	1.4	14.4
All species	9.2	10.7	—	19.9	4.9	1.4	15.5

[a] Less than 50,000 board feet.

[b] Includes shortleaf, Virginia and other pines, and hemlock.

[c] Includes basswood, cottonwood, elm, gum, sycamore, and other white oaks.

Table 12.—Sawlog production and receipts in the PENNYROYAL REGION of Kentucky, by species and destination of shipments, 1974

[In millions of board feet, International 1/4-inch rule]

Species	Cut and retained in region	Out-shipments		Total production	In-shipments		Total receipts
		To other regions	To other states		From other regions	From other states	
Pines [b]	2.3	0.3	0.1	2.7	3.1	(a)	5.4
Eastern redcedar	2.6	.2	(a)	2.8	(a)	0.1	2.7
Other softwoods	.8	—	—	.8	.1	—	.9
Total softwoods	5.7	0.5	0.1	6.3	3.2	0.1	9.0
Ash	3.1	0.3	0.2	3.6	0.9	0.1	4.1
Beech	9.2	1.3	.1	10.6	1.6	.3	11.1
Gum	1.7	.3	.1	2.1	.4	.1	2.2
Hickory	6.2	1.0	.1	7.3	1.1	.2	7.5
Hard maple	2.8	.5	(a)	3.3	.6	.1	3.5
Soft maple	2.1	.6	.1	2.8	.2	.1	2.4
Northern red oak	5.3	1.7	.3	7.3	.4	—	5.7
Black oak	11.2	2.8	.6	14.6	1.8	.3	13.3
Other red oak	16.6	3.4	.1	20.1	2.7	.5	19.8
White oak	7.6	1.6	.4	9.6	1.8	.1	9.5
Chestnut oak	3.9	.3	—	4.2	1.9	.1	5.9
Other white oak	.4	1.3	—	1.7	.1	—	.5
Yellow-poplar	14.8	2.3	.6	17.7	3.8	.6	19.2
Sycamore	1.3	.2	(a)	1.5	.2	.1	1.6
Black walnut	1.3	.1	.6	2.0	.1	.2	1.6
Other hardwoods [c]	2.5	.1	.1	2.7	.5	.1	3.1
Total hardwoods	90.0	17.8	3.3	111.1	18.1	2.9	111.0
All species	95.7	18.3	3.4	117.4	21.3	3.0	120.0

[a] Less than 50,000 board feet.

[b] Includes shortleaf, Virginia, and other pines.

[c] Includes basswood, cottonwood, and elm.

Table 13.—Sawlog production and receipts in the WESTERN COALFIELD REGION of Kentucky, by species and destination of shipments, 1974

[In millions of board feet, International 1/4-inch rule]

Species	Cut and retained in region	Out-shipments		Total production	In-shipments		Total receipts
		To other regions	To other states		From other regions	From other states	
Eastern redcedar	—	(a)	0.1	0.1	—	—	—
Other softwoods [b]	—	—	—	—	0.1	—	0.1
Total softwoods	—	(a)	0.1	0.1	0.1	—	0.1
Ash	4.2	0.2	—	4.4	0.5	0.9	5.6
Beech	3.5	.5	.3	4.3	1.2	.3	5.0
Cottonwood	2.7	.1	—	2.8	.4	.9	4.0
Elm	1.9	.1	—	2.0	.2	.2	2.3
Gum	7.8	.4	.5	8.7	.7	1.4	9.9
Hickory	10.6	.6	.8	12.0	1.3	1.6	13.5
Hard maple	3.2	.3	.1	3.6	.7	.5	4.4
Soft maple	6.0	.2	—	6.2	.7	1.6	8.3
Northern red oak	8.4	.1	1.0	9.5	1.6	.8	10.8
Black oak	9.6	1.0	.8	11.4	1.9	.6	12.1
Other red oaks	17.1	1.3	1.1	19.5	4.2	3.9	25.2
White oak	12.1	1.1	(a)	13.2	2.0	1.9	16.0
Chestnut oak	1.4	.1	—	1.5	.1	(a)	1.5
Other white oaks	3.8	.3	—	4.1	1.4	.3	5.5
Yellow-poplar	8.7	.9	1.4	11.0	1.3	1.6	11.6
Sycamore	3.0	.1	—	3.1	.2	.2	3.4
Black walnut	1.0	.1	—	1.1	.1	.2	1.3
Other hardwoods [c]	1.5	.1	—	1.6	.5	.4	2.4
Total hardwoods	106.5	7.5	6.0	120.0	19.0	17.3	142.8
All species	106.5	7.5	6.1	120.1	19.1	17.3	142.9

[a] Less than 50,000 board feet.

[b] Includes Virginia pine.

[c] Includes basswood.

Table 14.—Sawlog production and receipts in the WESTERN REGION of Kentucky, by species and destination of shipments, 1974

[In millions of board feet, International 1/4-inch rule]

Species	Cut and retained in region	Out-shipments		Total production	In-shipments		Total receipts
		To other regions	To other states		From other regions	From other states	
Pines	—	—	0.2	0.2	—	—	—
Other softwoods	—	—	—	—	—	—	—
Total softwoods	—	—	0.2	0.2	—	—	—
Ash	0.3	0.3	0.3	0.9	0.1	0.1	0.5
Cottonwood	.9	.3	(a)	1.2	(a)	.4	1.3
Gum	1.4	.5	.9	2.8	.1	.3	1.8
Hickory	1.8	.6	.5	2.9	.4	.6	2.8
Hard maple	.4	.2	.2	.8	.1	.1	.6
Soft maple	.7	.4	.1	1.2	.1	.2	1.0
Northern red oak	.8	.1	.1	1.0	—	.1	.9
Black oak	1.5	.4	1.0	2.9	.3	.4	2.2
Other red oaks	3.1	1.5	1.1	5.7	.4	.9	4.4
White oak	1.6	.6	.9	3.1	.1	.4	2.1
Other white oaks	.9	.2	.6	1.7	.2	.2	1.3
Yellow-poplar	.9	.3	1.0	2.2	.2	.2	1.3
Sycamore	1.0	(a)	.2	1.2	.1	.3	1.4
Other hardwoods [b]	.9	.6	.9	2.4	.5	.3	1.7
Total hardwoods	16.2	6.0	7.8	30.0	2.6	4.5	23.3
All species	16.2	6.0	8.0	30.2	2.6	4.5	23.3

[a] Less than 50,000 board feet.

[b] Includes basswood, beech, elm, and black walnut.

Table 15.—Sawlog production and receipts in KENTUCKY, by species and destination of shipments, 1974

[In millions of board feet, International 1/4-inch rule]

Species	Cut and retained in state	Exported to			Total production	Imported from			Total receipts
		Indiana	Tennessee	Other states		Indiana	Tennessee	Other states	
Hemlock	1.9	—	—	—	1.9	—	—	(a)	1.9
Shortleaf pine	16.8	—	—	—	16.8	—	(a)	(a)	16.8
Virginia pine	2.2	—	2.1	—	4.3	—	(a)	—	2.2
Other pines	3.0	—	.2	—	3.2	—	—	—	3.0
Eastern redcedar	3.7	—	.1	—	3.8	—	0.1	—	3.8
Other softwoods	2.3	—	—	—	2.3	—	—	—	2.3
Total softwoods	29.9	—	2.4	—	32.3	—	0.1	(a)	30.0
Ash	12.6	0.1	0.4	(a)	13.1	0.5	0.4	0.3	13.8
Beech	26.3	(a)	.7	0.1	27.1	.4	.9	.3	27.9
Gum	15.4	.1	1.4	—	16.9	.6	.8	.8	17.6
Hickory	37.6	.2	1.3	.1	39.2	.8	1.3	1.3	41.0
Hard maple	11.6	.1	.3	.1	12.1	.2	.4	.3	12.5
oft maple	13.9	.1	.1	(a)	14.1	.8	.4	.8	15.9
Northern red oak	31.9	.3	1.8	.3	34.3	.5	1.0	.7	34.1
Black oak	50.7	.4	3.4	.2	54.7	.4	1.1	1.1	53.3
Other red oaks	68.0	—	3.6	.1	71.7	1.6	2.2	1.6	73.4
White oak	43.7	.4	1.6	.2	45.9	1.1	.9	1.3	47.0
hestnut oak	25.0	—	1.3	.2	26.5	—	1.3	.4	26.7
ther white oaks	7.3	—	.5	—	7.8	.2	.1	.2	7.8
ellow-poplar	58.3	.6	2.6	.3	61.8	.8	1.3	.9	61.3
ther hardwoods [b]	29.6	.7	.9	.1	31.3	1.4	1.8	1.4	34.2
Total hardwoods	431.9	3.0	19.9	1.7	456.5	9.3	13.9	11.4	466.5
ll species	461.8	3.0	22.3	1.7	488.8	9.3	14.0	11.4	496.5

[a] Less than 50,000 board feet.

[b] Includes basswood, cottonwood, elm, sycamore, and black walnut.

Table 16.—Pulpwood production in Kentucky, by species groups, 1955-1974 [a]

[In thousands of rough cords]

Year	All species	Softwoods	Hardwoods
1955	34.6	12.8	21.8
1956	53.4	25.0	28.4
1957	36.1	22.3	13.8
1958	35.1	16.3	18.8
1959	51.7	21.0	30.7
5-year total	210.9	97.4	113.5
1960	76.6	33.0	43.6
1961	73.4	31.6	41.8
1962	82.2	33.7	48.5
1963	72.4	37.5	34.9
1964	71.7	39.1	32.6
5-year total	376.3	174.9	201.4
1965	101.2	37.4	63.8
1966	114.0	30.1	83.9
1967	159.9	34.8	125.1
1968	177.1	29.9	147.2
1969	167.9	34.4	133.5
5-year total	720.1	166.6	553.5
1970	239.6	26.3	213.3
1971	304.3	29.0	275.3
1972	320.1	29.7	290.4
1973	438.2	43.2	395.0
1974	396.4	33.7	362.7
5-year total	1,698.6	161.9	1,536.7

[a] Includes production from roundwood and manufacturing residues.

Table 17.—Pulpwood harvest in Kentucky, by species groups and geographic regions, 1965-1974

[In thousands of rough cords]

Species groups and region	Pulpwood harvest in: 1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	All years
Softwoods:											
Eastern	—	—	—	—	4.8	—	—	—	—	—	4.8
North Cumberland	12.5	3.1	3.6	3.3	.3	3.2	4.0	4.7	16.1	2.2	53.0
South Cumberland	23.5	22.3	19.7	19.8	18.0	15.7	15.8	16.8	13.9	19.0	184.5
Bluegrass	2.5	1.9	2.2	.9	2.1	.3	2.7	1.0	.9	.2	14.7
Pennyroyal	3.5	2.8	2.4	2.5	2.3	2.1	1.0	1.9	3.1	3.4	25.0
Western Coalfield	1.6	—	—	—	—	—	—	—	—	—	1.6
Western	—	—	—	—	—	.3	1.3	.2	—	—	1.8
All regions	43.6	30.1	27.9	26.5	27.5	21.6	24.8	24.6	34.0	24.8	285.4
Hardwoods:											
Eastern	—	—	—	0.2	—	—	—	—	—	—	0.2
North Cumberland	34.9	31.9	30.6	22.0	24.3	25.0	34.8	34.2	73.9	46.1	357.7
South Cumberland	13.1	13.1	10.6	13.3	17.6	19.7	14.6	19.9	16.3	12.0	150.2
Bluegrass	.5	2.0	6.1	4.3	4.4	2.7	36.3	4.0	21.7	.1	82.1
Pennyroyal	—	—	—	.3	2.8	18.5	3.9	19.0	11.8	15.9	72.2
Western Coalfield	6.2	5.7	5.3	15.2	5.7	13.8	37.7	43.6	31.0	16.1	180.3
Western	.2	3.8	5.4	1.1	1.3	13.9	24.2	18.1	17.6	18.1	103.7
All regions	54.9	56.5	58.0	56.4	56.1	93.6	151.5	138.8	172.3	108.3	946.4
All species	98.5	86.6	85.9	82.9	83.6	115.2	176.3	163.4	206.3	133.1	1,231.8

Table 18.—Veneer-log production in Kentucky, by species and consuming states, 1974

[In thousands of board feet, International 1/4-inch rule]

Species	Cut and retained in Kentucky	Exported to: Indiana	Tennessee	Other states [a]	Total production
Ash	45	1	—	—	46
Cottonwood	—	9	—	1,261	1,270
Hickory	287	24	100	265	676
Maple	32	15	8	—	55
Red oak	417	203	—	132	752
White oak	205	296	—	—	501
Sycamore	31	61	40	—	132
Sweetgum	62	77	100	—	239
Black walnut	986	673	—	—	1,659
Yellow-poplar	125	44	595	—	764
Other species [b]	181	57	—	—	238
All species	2,371	1,460	843	1,658	6,332

[a] Includes Missouri, North Carolina, and West Virginia.
[b] Includes elm and other oaks.

Table 19.—Veneer-log receipts in Kentucky, by species and producing states, 1974

[In thousands of board feet, International 1/4-inch rule]

Species	Cut and retained in Kentucky	Imports from:						Total receipts
		Michigan	Ohio	Indiana	Missouri	Pennsylvania	Other states [a]	
Ash	45	40	11	80	—	—	—	176
Sweetgum	62	—	—	—	—	—	—	62
Hickory	287	—	—	100	28	—	720	1,135
Maple	32	34	—	34	—	—	—	100
Red oak	417	150	25	214	—	280	110	1,196
White oak	205	94	75	435	38	40	175	1,062
Yellow-poplar	125	—	—	9	—	—	—	134
Black walnut	986	—	50	799	639	19	186	2,679
Other species [b]	212	—	—	50	—	15	100	377
All species	2,371	318	161	1,721	705	354	1,291	6,921

[a] Includes Tennessee, Illinois, Wisconsin, Texas, Arkansas, Mississippi, Louisiana, Virginia, Idaho, and West Virginia.
[b] Includes pines, elm, and sycamore.

Table 20.—Veneer-log production, receipts, and number of plants in Kentucky for selected years.

[In millions of board feet, International 1/4-inch rule]

Year	Number of operating plants	Production	Receipts
1948	6	9.6	5.8
1956	8	12.5	8.1
1958	5	12.1	6.3
1960	2	8.0	2.9
1963	3	11.2	2.5
1968	4	8.4	6.2
1969	4	7.6	7.0
1972	4	5.6	8.5
1974	4	6.3	6.9

Table 21.—White oak cooperage-log and bolt production and receipts and number of operating mills in Kentucky for selected years, 1948-1974

[In millions of board feet, International 1/4-inch rule]

Year	Number of operating mills	Production	Receipts
1948	87	38.8	44.0
1958	19	19.4	22.3
1960	33	29.8	28.2
1962	26	20.5	21.0
1964	21	21.4	21.4
1969	23	22.4	20.8
1974	12	12.2	13.4

Table 22.—Production and distribution of manufacturing residues, by type of residues, type of uses, and industry sources, Kentucky, 1974

[In thousands of cubic feet]

Source industry	Type of use	Type of residue			All types
		Bark	Coarse [a]	Fine [b]	
Lumber	Fiber	—	17,683	1,719	19,402
	Fuel [c]	589	1,360	343	2,292
	Agricultural [d]	—	—	1,131	1,131
	Other [e]	2,215	1,782	2,539	6,536
	All uses	2,804	20,825	5,732	29,361
	Unused	6,353	1,309	8,243	15,905
Veneer	Fiber	—	544	—	544
	Fuel	61	32	130	223
	Agricultural	—	—	—	—
	Other	—	—	—	—
	All uses	61	576	130	767
	Unused	64	57	135	256
Cooperage	Fiber	—	847	34	881
	Fuel	46	12	—	58
	Agricultural	17	—	41	58
	Other	46	98	41	185
	All uses	109	957	116	1,182
	Unused	134	271	99	504
Other industries	Fiber	—	237	—	237
	Fuel	67	237	21	325
	Agricultural	—	—	17	17
	Other	34	173	19	226
	All uses	101	647	57	805
	Unused	113	431	132	676
All industries [f]	Fiber	—	19,311	1,753	21,064
	Fuel	763	1,641	494	2,898
	Agricultural	17	—	1,189	1,206
	Other	2,295	2,053	2,599	6,947
	All uses	3,075	23,005	6,035	32,115
	Unused	6,664	2,068	8,609	17,341

[a] Coarse residues include slabs, edgings, trimmings, veneer cores, and other material suitable for chipping.

[b] Fine residues include sawdust, shavings, and other material considered unsuitable for chipping.

[c] Includes both domestic and industrial fuel.

[d] Includes livestock bedding and farm and horticultural mulch.

[e] Includes small dimension, charcoal wood, and metallurgical chips.

[f] Excludes the pulpwood industry.

Table 23.—Volume of unused sawmill residues, by geographic regions, species groups, and types of residues, Kentucky, 1974

[In thousands of cubic feet]

Geographic region	All species			Softwoods			Hardwoods		
	Bark	Coarse	Fine	Bark	Coarse	Fine	Bark	Coarse	Fine
Eastern	699	103	897	21	11	27	678	92	870
North Cumberland	1,459	508	1,949	103	82	128	1,356	426	1,821
South Cumberland	609	215	1,068	55	31	119	554	184	949
Bluegrass	185	38	237	—	3	—	185	35	237
Pennyroyal	505	168	847	12	30	56	493	138	791
Western Coalfield	2,465	265	2,928	—	—	—	2,465	265	2,928
Western	431	12	317	—	—	—	431	12	317
All units	6,353	1,309	8,243	191	157	330	6,162	1,152	7,913

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1977. **The timber industries of Kentucky.** Northeast. For. Exp. Stn., Upper Darby, Pa.
26 p., illus. (USDA For. Serv. Resour. Bull. NE-50).

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USDA FOREST SERVICE RESOURCE BULLETIN NE-51
1977

NORTHEASTERN FOREST EXPERIMENT STATION
FOREST SERVICE, U.S. DEPARTMENT OF AGRICULTURE
6816 MARKET STREET, UPPER DARBY, PA. 19082

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THE FOREST-LAND OWNERS OF NEW HAMPSHIRE AND VERMONT

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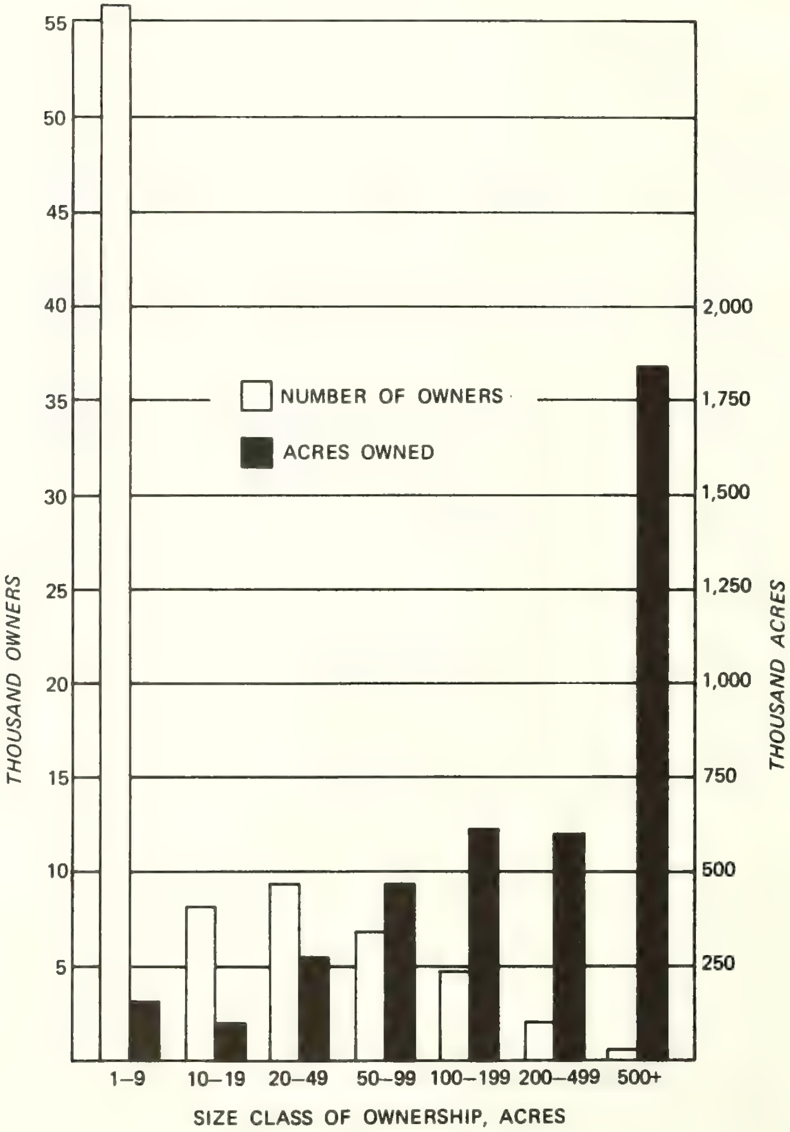
Figure 1.—Estimated number of forest-land owners in NEW HAMPSHIRE, and total acreage owned, by size class, 1973.



THE FOREST LAND AND ITS OWNERS

THE RECENTLY COMPLETED forest surveys of New Hampshire and Vermont provided estimates of forest area and timber volume by broad owner categories *(Kingsley 1976 and 1977)*. However, these reports did not provide estimates of the volume of timber or the acreage of commercial forest land that is currently available for harvesting. Nor did they provide descriptions of typical forest-land owners, their reasons for owning forest land, or their attitudes toward timber harvesting, forest management, and the recreational use of their lands by the public.

This information is needed by public agencies for planning and organizing forestry and related programs geared to forest-land owners. It is also useful to forest industries that wish to locate available supplies of timber, as well as to people who are interested in further research on the motivation and objectives of forest-land owners. An understanding of the forest-land owners is particularly important in understanding the entire forest-resource situation in New Hampshire and Vermont, because the overwhelming portion of commercial forest land in these states is privately owned. In New Hampshire 87 percent of the commercial forest land is in private ownership, and in Vermont 90 percent is in private ownership.

The purpose of this report is to provide this information in a form that facilitates its use in conjunction with the data provided in the resource reports. The data presented here are based on a sample of forest-land owners in the two states. The results of this sample have been statistically expanded to provide an estimate of the total population of owners of privately held forest land and the acreage that they own. For this reason the user of this report should consider it as presenting a broad overview of the forest ownership situation in New Hampshire and Vermont. Further, the user is strongly advised to read the definitions of terms and the discussion of study design and sampling errors presented in the appendixes of this report.

Historically, forestry and farming have played significant roles in the development of both New Hampshire and Vermont. In recent decades, however, agriculture and timber production have declined in relative economic importance. Yet the rural populations of both states have been increasing. During the 1960s New Hampshire's rural population grew 27.1 percent, and Vermont's grew 25.6 percent (*U.S. Bureau Census 1970*). The reason for this increase in rural—primarily nonfarm—population is that, with increased mobility, many former urban residents have been able to live in a rural environment while continuing to be employed in urban areas. These former urban residents often have different backgrounds and interests than the lifelong rural resident. Because of this, these people are having a profound influence on what is happening to forest land and the ownership of it in both states. Tenure, size, and the objectives of ownership are often greatly affected by the owner's background.

There are an estimated 164,800 owners of privately held commercial forest land in Vermont and New Hampshire. In Vermont 77,300 owners hold nearly 4 million acres. In New Hampshire 87,500 own 4.1 million acres. In Vermont the average private ownership is 51.6 acres; in New Hampshire 46.6 acres.

Ownerships in the two states range in size from 1 acre to more than 325,000 acres. However, both the median and modal size of ownerships fall in the 1- to 9-acre size class. This means that most owners own fewer than 10 acres. Although 54 percent of the owners hold only 3 percent of the commercial forest land, 39

Figure 2.— Estimated number of forest-land owners in VERMONT, and total acreage owned, by size class, 1973.

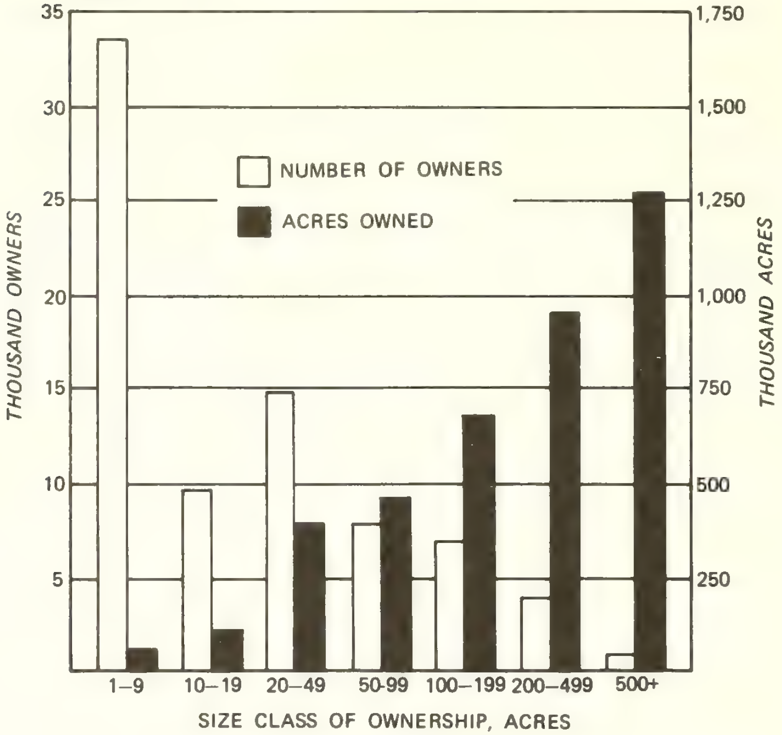
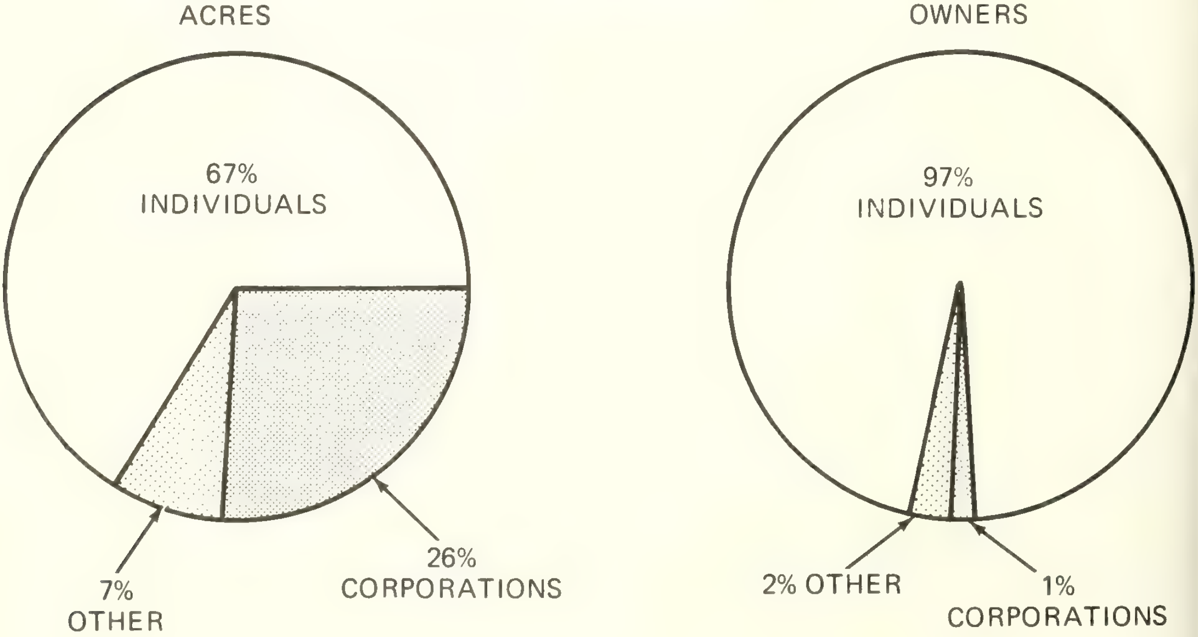


Figure 3.—Percentage of all owners and proportion of total acreage they own, by form of ownership, NEW HAMPSHIRE and VERMONT, 1973.



percent of this land is controlled by the 1 percent of the owners who own 500 acres or more. Figures 1 and 2 show the number of owners and acres of commercial forest land owned, by size class of ownership, in New Hampshire and Vermont.

Individuals account for 97 percent of the owners and 67 percent of the private commercial forest land. Although corporations account for only 1 percent of the owners, they own 26 percent of the commercial forest land. The remaining 2 percent of the owners and 7 percent of the land is accounted for by partnerships, undivided estates, and clubs and associations (fig. 3).

The Individual Forest-Land Owner

The development of many industries in New Hampshire and Vermont probably accounts for the fact that more than 44 thousand individual owners reported their occupations as skilled labor. These 27 percent of all owners account for only 6 percent of the land. Other important owner groups are white-collar workers, professionals, retired persons, and executives. These latter groups account for 42 percent of the owners, and they own 40 percent of the privately owned commercial forest land.

Consistent with the decline in the importance of agriculture in the two states is the fact that only 5 percent of the owners are farmers. However, farmers have the highest average acreage of any occupation group—more than 88 acres per owner. They account for 14 percent of the commercial forest land. It should be pointed out that in this study farmers are defined as those owners whose primary source of income is farming. Not included are owners who are part-time farmers or retired farmers. This is in contrast with the U.S. Bureau of the Census definition as used in the 1969 Census of Agriculture, which includes these two groups *(U.S. Bureau of Census 1969)*.

New Hampshire and Vermont forest-land owners are by and large well educated and affluent. Sixty percent of the individual owners have more than a high school education, and 5 percent have either Ph.D or M.D. degrees. These 60 percent hold 63 percent of the 5.4 million acres held by individuals. In this two-state region, 55 percent of the forest-land owners have incomes of $10,000 per year or more. In fact, one-third have incomes of $15,000 or more. Not surprisingly, this 55 percent own 72 percent of the commercial forest land held by individuals.

When we look at ages, length of ownership, place of residence, and early life background of the forest-land owners of New Hampshire and Vermont, we begin to get an idea of what has been happening to forest-land ownership in these states in recent years. Nearly 50 percent of the individuals who own forest land in the two states are 45 years old or older, and these owners hold 75 percent of the commercial forest land—4.1 million acres. Fifty-three percent of all owners have owned their forest land for fewer than 10 years. These owners control only 27 percent of the privately held forest land. At the opposite extreme, 2 percent of the owners have held woodland for more than 50 years, and they control 14 percent of the commercial forest land.

The majority—83 percent—of the owners live either on their land or within 5 miles of it. These owners hold 79 percent of the private commercial forest land. The nonresident or absentee owner is often spoken of as constituting a very important segment of the landowner population. However, the results of our study show that owners whose primary place of residence is more than 50 miles from their land account for only 11 percent of the owners and 12 percent of the land. As for early life background, more than one-third of the individuals who own forest land in New Hampshire and Vermont spent the first 12 years of their lives in a city or a town of more than 15,000 population. These owners hold 35 percent of the commercial forest land held by individuals.

From this description one can sense that many of the present owners in New Hampshire and Vermont own forested land and live where they do by choice rather than by chance. Our data reflect what has often been surmised: that many owners are emigrees from urban areas who have sought a better living environment. How they will influence land-use patterns, forest policy, timber production, and forest management in the region is a continually unfolding picture.

Although forest-land owners in Vermont are somewhat older than those in New Hampshire and own slightly more forest land, the profiles of the typical owner in these states are strikingly similar:

Forest-Land Owner Profiles

Category	*New Hampshire*	*Vermont*
Age	Under 45	45 to 64
Education	Beyond high school	Beyond high school
Income	$10,000 to $15,000	$10,000 to $15,000
Early life environment	Rural	Rural
Occupation	Skilled laborer	Skilled laborer
Length of ownership	5 to 9 years	5 to 9 years
Size of tract	1 to 9 acres	10 to 19 acres
Distance from nearest tract	Less than 5 miles	Less than 5 miles
Number of tracts	1	1
Reason for owning	Part of residence	Part of residence

Corporate and Other Owners

Corporations own 22 percent of the privately owned commercial forest land in Vermont and 31 percent in New Hampshire. Yet corporations account for only 1 percent of the owners in both states. This means that the average corporation in the two states holds 1,167 acres of commercial forest land.

Forest-based industries are by far the largest corporate holders of commercial forest land, owning 666,300 acres in Vermont and 946,900 acres in New Hampshire. Forest industries account for less than 0.5 percent of all owners in either state. Real-estate development companies hold an estimated 115,800 acres of commercial forest land in Vermont and 127,300 in New Hampshire. Nonforest industries hold 104,000 acres, and nonindustrial businesses hold 25,500 in the two states. Incorporated farms, which are often important corporate landowners in more agricultural states, hold only 27,300 acres of commercial forest land in the two states—less than 0.5 percent. Other ownerships, such as clubs and associations, churches, youth organizations, and educational institutions hold an estimated 143,900 acres or about 2 percent of the commercial forest land in the two-state region.

OWNER OBJECTIVES

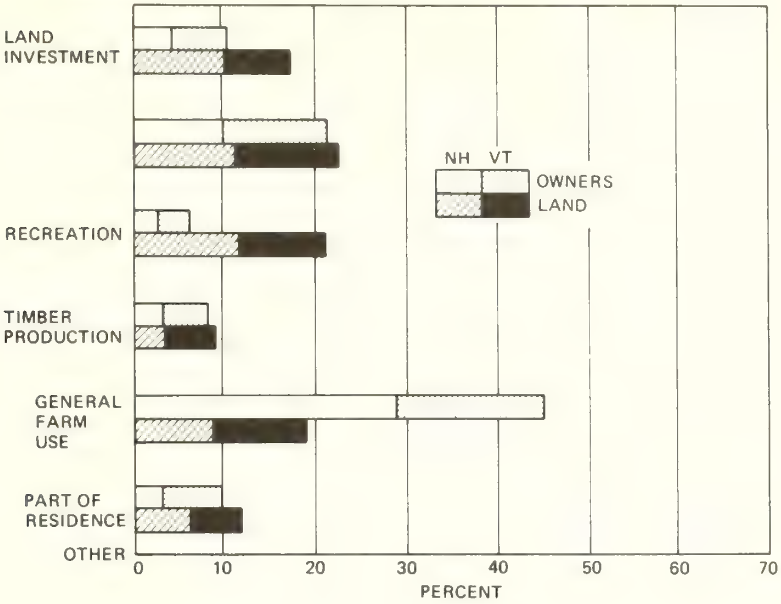
Why People Own Forest Land

Though only 10 percent of the owners said that they own their forest land for investment purposes (fig. 4), 21 percent said that increased value is the major benefit they derived from their forest land during the past 5 years. Further, 26 percent said they expect the increase in land value to be an important benefit in the coming 5-year period. These owners, those to whom increased land value is a reason for owning forest land and those who consider it a past or future benefit, own tracts that slightly exceed the average tract size in the two states—about 49 acres.

Marler and Graves *(1974)* have suggested that, since the value of land rarely decreases, many owners perceive speculation as an objective that is likely to be fulfilled. Our data lend credence to this suggestion and further indicate that many owners who may not have acquired forest land with speculation in mind have found it to be a major benefit in the past, and even more expect it to be an important benefit in the future.

One frequently hears statements to the effect that individuals seldom acquire or hold land in

Figure 4.—Reasons for owning commercial forest land in NEW HAMPSHIRE and VERMONT, by percentage of owners and acreage, 1973.



New Hampshire or Vermont in anticipation of increasing land values. However, our data do not support this conclusion. In Vermont an estimated 33 percent of all owners indicated that they expected the increase in land value to be the most important benefit they would derive from owning forest land. In New Hampshire 19 percent indicated the same reason.

An estimated 45 percent of the owners of private commercial forest land in New Hampshire and Vermont said they owned their land simply because it was part of their residence. These owners tend to hold smaller-than-average tracts—about 21 acres on average. Many of these owners were among those who indicated that the increase in land value is an important past and future benefit. Many others felt that esthetic enjoyment was the most important past and future benefit. The psychological sense of wellbeing from being surrounded by "green space" and the privacy it provides are important to many owners in this region. Of all owners, 36 percent felt that their esthetic enjoyment of the land was most important in the past 5 years and 50 percent expected it to be the most important in the coming years.

Recreational enjoyment is perhaps the most complex of all ownership objectives because there are so many forms of recreation that can take place on forested land. To ensure pleasurable recreational experiences for themselves, many owners have purchased forest land. Twenty-one percent of all owners gave recreation as the primary reason they owned forest land. Nineteen percent of the owners felt that recreational enjoyment was the most important benefit in the past 5 years, but only 10 percent felt that recreation would be the most important benefit received in the next 5 years. It is not really possible to say what benefit those owners who indicated recreational enjoyment in the past but not in future expect to be the important benefit in the future. However, in a region like New Hampshire and Vermont it is all but certain that the majority would expect the increase in land value to be most important.

"Timber production" and "farm or domestic use" are closely related ownership objectives. The only major difference between them is that in the first case the timber products are sold and that in the second case the timber products—usually fuelwood, fence posts, and farm timbers—are retained and used by the property owner. Only 6 percent of the owners in the two states listed timber production as a reason for owning forest land. These owners control 21 percent of the commercial forest land in the two states. It is interesting to note that only 1.3 percent indicated timber production as the most important reason for owning forest land, 3.2 percent list it as the second most important reason, and the remaining 1.5 percent listed it as less than the second most important.

Income from the sale of timber was an important benefit of owning forest land for 3 percent of the owners in New Hampshire and Vermont. These owners hold 15 percent of the woodland. Only 2 percent of the owners expect income from the sale of timber to be an important benefit in the coming 5 years. These owners hold 10 percent of the forest land.

The explanation of why fewer owners perceived a past or future benefit from the sale of timber than indicated timber production as an ownership objective may be twofold. First, forest industry owners, though they own forest land for timber production, often sell none of their timber to others. Therefore these owners cannot logically indicate income from the sale of timber as a land-holding benefit. The second reason may be the time frame. Timber growing is a long-term business, and undoubtedly many owners who own forest land for timber production did not consider income from the sale of timber as a major benefit over the 5-year period, but would over a longer time span.

Eight percent of the owners listed farm and domestic use as their reason for owning forest land, and they own 9 percent of the commercial forest land. Thirteen percent of the owners stated that farm and domestic use was important in the last 5 years. These owners control 9 percent of the forest land. Owners of 9 percent of the commercial forest land said they expect timber production for farm and domestic use to be important in the coming 5 years.

Predicting the Owner's Future Harvesting Intentions

Which owners are most likely to harvest timber and which are least likely to? To answer this question we have analyzed several combinations of responses to various questions in the questionnaire. To accomplish this analysis we used the multivariate analysis technique called AID III (Automatic Interaction Detector) *(Sonquist and others 1971)*. This technique was used to analyze the harvesting intentions of forest-land owners in three future time frames: the next 5 years, the next 10 years, and some indefinite future date.

By comparing a respondent's answers to selected questions with his answer to the question of whether or not he intends to harvest in each of the three time frames, the AID computer program selects the question that is most significantly related to whether or not the owner intends to harvest, and then it groups the responses. It continues this process until no further significant sorting can be made. Thus the ending groups will contain either a very high proportion of owners who intend to harvest or a very low proportion.

An earlier version of the AID technique was used to explain the intent of 394 Pennsylvania forest-land owners to sell or not to sell timber in the next 5-year period *(Larsen and Gansner 1973)*. They found that those owners who had harvested in the past had a high inclination to harvest in the future. While we found that a similar relationship existed also in Vermont and New Hampshire, our analysis was concerned primarily with identifying those owners most likely to harvest timber, based on the interests or characteristics of the owner or of the land he owns.

Only questionnaires from those respondents who answered the question about future intention to harvest could be used in this analysis. Thus, of the 716 samples taken in New Hampshire and Vermont, 693 were used in this analysis. These responses represented an estimated 150,767 owners and accounted for an estimated 6,932,255 acres of commercial forest land or about 86 percent of the total for the two states.

Analysis 1: Intention to Harvest Some Time During the Next 5 Years.

Group 1 (fig. 5) represents all the samples included in this analysis. Only 6.7 percent of the owners replied that they intend to harvest during the next 5 years. These owners hold 45 percent of the commercial forest land in the analysis—3,119,500 acres.

Group 1 was divided in Groups 2 and 3, based on the owner's reason for owning forest land. A total of 31 combinations of possible answers were developed, based on the two most important reasons the owner listed for owning forest land. Only 2.6 percent of the respondents in

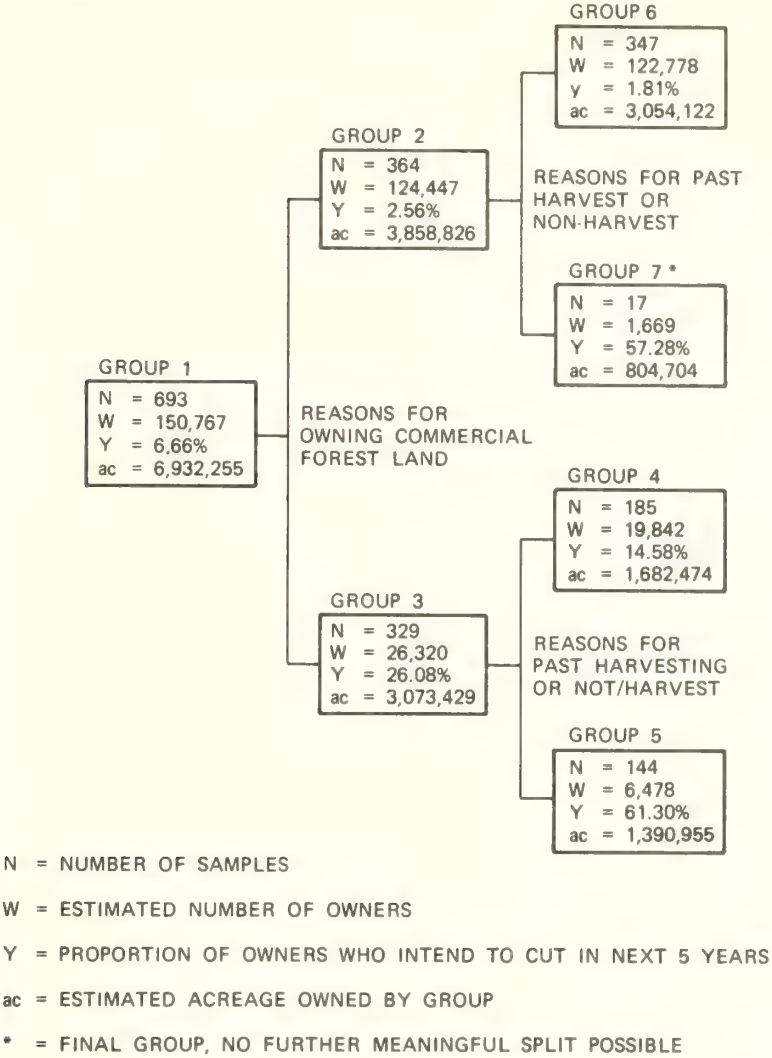


Figure 5.—Analysis 1: intention to harvest within the next 5 years.

Group 2 intend to harvest in the next 5 years. Group 3 had 26.1 percent who intend to harvest. The majority of the owners in Group 2 said that being part of their residence or an interest in recreation were the first or second reasons for owning forest land. The majority of the owners in Group 3 gave timber production or farm or domestic use as their land-owning objectives. The owners who listed land investment as an important objective were divided nearly evenly between the two groups.

The owners in Group 2 who intend to harvest in the next 5 years represent 1,419,200 acres of commercial forest land. In Group 3 the owners who intend to harvest represent 1,700,300 acres.

Groups 2 and 3 were divided into Groups 4, 5, 6, and 7, based on the respondents' reasons for harvesting or not harvesting timber in the past. In Group 4, 14.6 percent of the owners said they intend to harvest in the next 5 years. The majority of the owners in Group 4 have never harvested timber in the past. Of those who had harvested in the past, most said they did so because they needed the timber for their own use or because they needed money. Those who had not harvested said they had not because their timber was not mature or that they were opposed to timber harvesting.

In Group 5 most of the owners, 61.3 percent, intend to harvest within the next 5 years. Owners in this group own an average of 214 acres. Most of the owners in this group who have harvested said that they did so because the timber was mature, that they harvested in conjunction with land-clearing, or that they had harvested for company use.

Only 1.8 percent of the owners in Group 6 have any intention to harvest during the next 5 years. Many owners in Group 6 gave reasons for not harvesting that would be likely to preclude harvesting at anytime in the future, such as the belief that logging would destroy the scenery or that they had insufficient area for harvesting. That many owners in this group may in fact have an insufficient area to harvest is borne out by the fact that this group has the lowest average acreage of any of the 7 groups—only 25 acres.

People in Group 7 had only two reasons for past harvesting or not harvesting. The majority said they had harvested in the past because they needed the timber for their own use, and the remainder said they had not harvested in the past because the land had been tied up in an estate. The owners in Group 7 own an average of 482 acres each. Of these owners, 57 percent intend to harvest within the next 5 years.

Generally this analysis showed that the owner who is unlikely to harvest timber during the next 5 years usually owns less forest land than the average owner. He owns his land for recreational purposes or because it is part of his residence. He is also unlikely to have ever harvested timber from his land previously because he is philosophically opposed to harvesting, he has too little area for harvesting, or he feels that harvesting would destroy the scenery. If he in fact has harvested timber before, it is very likely he did so only because he needed money.

Those owners that are likely to harvest during the coming 5 years typically own large areas of forest land either for timber production or for farm or domestic use. They also have harvested before because the timber was mature, or for company use or their own use, or because they were clearing some land. If they have not harvested in the past it was probably because the land is part of an undivided estate.

Analysis 2: Intention to Harvest Some Time During the Next 10 Years.

Group 1 in figure 6 represents all the samples included in the analysis. This analysis proved to be nearly identical to Analysis 1. However, it uncovered an additional 4,862 owners who plan to harvest some time between 5 and 10 years from now. Thus 9.9 percent of the owners intend to harvest within the coming 10 years, and they own 53 percent of the commercial forest land in the analysis.

Analysis 3: Intention to Harvest at Some Time in the Future.

This analysis included all those owners in Analyses 1 and 2 plus those owners who reported that they intend to harvest "some day", but were unable to specify a time frame or plan the harvest at some time beyond the 10-year horizon. Group 1 (fig. 7) represents all the samples included in this analysis. Of the 150,767 owners estimated to be in this group, 56,980 plan to harvest timber from their land some day. These owners hold 87 percent of the privately owned commercial forest land.

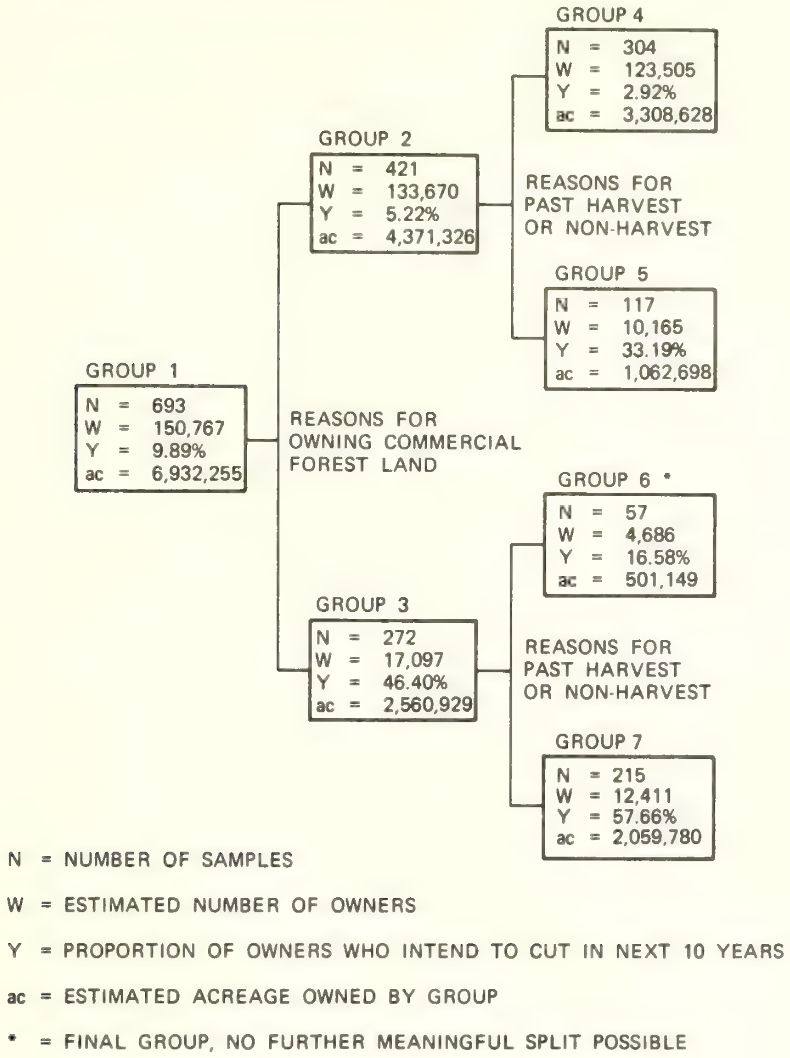
Group 1 was divided into Groups 2 and 3 on the acreage of forest land owned in the State by each respondent in the analysis. Group 2 contains all the owners of fewer than 20 acres. Owners in this group hold an average of 4 acres each, and 83 percent of them reported that they never intend to harvest timber.

Group 3 contains all the owners of 20 acres or more, and 79 percent of these owners said that they intend to harvest timber some time in the future. The owners in this group hold 129 acres on average.

Because Group 2 contained only 49 samples, a significant further split could not be obtained. However, Group 3 was further divided into Groups 4 and 5, based on the owners' reasons for harvesting or not harvesting in the past. All the owners in Group 4 have never harvested in the past and many reported that they did not for fear that the scenery would be destroyed. In Group 4, 42 percent of the owners said they plan to harvest some time. The average number of acres owned by owners in Group 4 was 89.

In Group 5, 88 percent of the owners, with an average acreage of 139 acres, said they plan to harvest some day. The majority of the owners in Group 5 have harvested in the past. These owners often said that they harvested because the timber was mature, that they needed

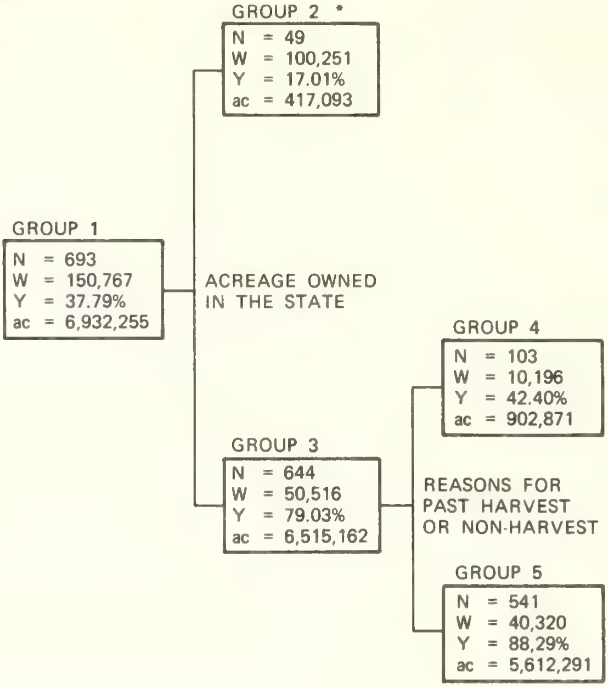
Figure 6.—Analysis 2: intention to harvest at some time during the next 10 years.



money, or that they needed the timber for their own use or for company use. Those owners who have not harvested gave reasons like the fact that their timber was immature, that they did not have enough volume, or that the timber was of poor quality.

A comparison of Analyses 1 and 2 with Analysis 3 showed that, though relatively few owners have definite timber-harvesting intentions, a substantial number have a vague or undefined interest in harvesting timber. Generally, those with a well-defined interest in harvesting timber own substantial tracts. And, of course, those in forest industry fall in this group. Those with a poorly defined intention to harvest generally hold intermediate-size tracts, and those with no intention to harvest hold small tracts. The belief has often been expressed that because only a small portion of commercial forest is held by owners who hold it for timber production—21 percent in New Hampshire and Vermont—little of the standing timber in an area is available for harvesting. The AID analysis showed that this is an erroneous conclusion. What was shown is that few owners give much thought to the timber and the income-producing potential of their forest land. And even fewer expend any effort to improve that productive potential.

Figure 7.—Analysis 3: intention to harvest at some future date.



N = NUMBER OF SAMPLES

W = ESTIMATED NUMBER OF OWNERS

Y = PROPORTION OF OWNERS WHO INTEND TO CUT AT SOME FUTURE TIME

ac = ESTIMATED ACREAGE OWNED BY GROUP

* = FINAL GROUP, NO FURTHER MEANINGFUL SPLIT POSSIBLE

HOW MUCH TIMBER IS AVAILABLE?

Another major objective of this study was to estimate the volume of timber that might be available for harvesting. The answer or answers to this question will be influenced by how the estimator defines availability and what assumptions he uses to develop the estimate. The estimate itself will be influenced by many social and economic factors. The utility of any estimate is limited to the time to which it applies, because changing industrial situations, land and timber market conditions, and social and economic conditions can interact to determine how much timber could be brought to market.

When an owner says that he is or is not willing to harvest timber, it does not necessarily mean that the timber on his land will or will not ever be harvested. The ownership of forest land is not static. An acre that is owned today by an owner who will not harvest may be owned tomorrow by someone who is very interested in timber production, and vice versa. In point of fact, 57 percent of the commercial forest land in New Hampshire and Vermont has been in the same ownership for fewer than 25 years and 27 percent for fewer than 10 years. Thus there is a better than 1 in 4 chance that any given acre will change hands during the next decade. If that acre is part of a small ownership, the chance is greatly increased. Table 9 of the appendix shows that 61,500 owners have held their land for fewer than 5 years. These owners hold, on average, less than 18 acres. At the opposite extreme, the 3,900 owners who have held forest land for 50 years or more hold an average of nearly 291 acres.

In approaching the question of availability we have chosen to make three separate estimates for each state, using three entirely different approaches.

New Hampshire

First, the high or optimistic estimate. The previous AID analyses indicated, and table 21 confirms, that in New Hampshire 86 percent of the commercial forest land is owned by owners who express a willingness to harvest timber. Thus, we might say that a total of 3,501,300 acres is available to harvesting. Since there is no basis for concluding that this land is any more or less adequately stocked or productive than the average of all commercial forest land in New Hampshire, we may conclude that there are 4.8 billion cubic feet of growing-stock inventory, and that 172 million cubic feet of net annual growth is available for harvesting. The available inventory volume would be the total supply of available growing stock, and the available net annual growth may be taken as the volume that could be removed annually without depleting the total supply.

The weakness of this admittedly optimistic estimate is that group of owners who expressed an indefinite intention to harvest. These owners account for 31 percent of the privately owned commercial forest land in New Hampshire. How many of these owners, if approached to sell timber, would in fact place such unreasonable restrictions on harvesting, would demand such a high stumpage price, or would have such a poor logging chance as to make their timber, for all practical purposes, unavailable? We must recognize that just because an owner expresses a willingness to harvest does not mean he necessarily has now or ever will have timber available for harvesting. To develop a more realistic estimate we have taken a different approach to this question.

The owners of an estimated 1,432,100 acres of private commercial forest land in New Hampshire have not harvested timber in the past. Many of these owners have not for reasons that would seem to preclude the possibility of a timber harvest during the present owner's tenure. These reasons are:

1. Logging would destroy the scenery.
2. The owner distrusts loggers.
3. The owner feels he has an insufficient area to permit harvesting.
4. The owner is opposed philosophically to the harvesting of timber from his land.
5. The owner feels that harvesting would destroy the land for hunting or wildlife.
6. The owner is in the process of selling the land.
7. The land is tied up in an estate settlement.
8. Logging, in the owner's opinion, would constitute a fire hazard.

In all, it is estimated that the owners of 841,200 acres of commercial forest land would give one or more of these reasons for not harvesting. Subtracting this acreage from the 4,082,100 acres of privately owned commercial forest land in the State leaves 3,240,900 acres. However, this cannot be considered the current base of available land because an additional 82,200 acres are held by past harvesters who report that they will not harvest in the future. This acreage must also be subtracted, further reducing the base to 3,158,700 acres or 77 percent of the commercial forest land in private ownerships. Applying the same criteria as earlier, we can say that there are 4.3 billion cubic feet of available growing-stock inventory and 155 million cubic feet of net annual growth available.

A minimum estimate may be obtained by looking at what owners say they intend to do. The owners of an estimated 2,225,100 acres in New Hampshire intend to harvest sometime within the coming 10 years. Since these people have rather definite plans, it seems reasonable to assume that they own mostly larger timber and larger tracts.

If we asume that in any single year 10 percent of these owners will offer their timber for harvesting, we can estimate that 620 potential timber sellers will be in the market. According to Herrick (*1975*) the median acreage of logging operations in the Northeast is 100 acres, and a median volume of 700 cubic feet is removed from each acre. If we assume that these median values hold for New Hampshire, we can make an estimate of the volume that may be available. If there are 620 owners who will offer their timber for harvesting, then there will be 62,000 acres (620 x 100) that will be available for harvesting. If the median volume removed is 700 cubic feet, then we can expect that 43.4 million cubic feet (62,000 x 700) of timber will be made available.

In 1972, 54.2 million cubic feet of growing stock was removed from privately owned commercial forest land in new Hampshire *(Kingsley 1976)*. This would indicate that many owners in New Hampshire havest timber without previous long-range plans.

Vermont

In Vermont 88 percent of the privately owned commercial forest land is owned by people who have expressed a willingness to harvest timber. Thus there are 3,517,300 acres available for harvesting. In Vermont this represents 3.8 billion cubic feet of inventory and 84.8 million cubic feet of annual net growth.

Taking the second approach, we find that the owners of 1,352,100 acres of private commercial forest land in Vermont have not harvested timber. A total of 526,900 acres is held by owners who have not harvested for reasons that would preclude a future harvest. And an additional 90,200 acres are owned by persons who have harvested timber but report that they do not plan to do so again. This leaves a timber-producing acreage of 3,371,200 acres. Thus, applying the same criteria as earlier, we conclude that there are 3.6 billion cubic feet of available inventory and 81.2 million cubic feet of available annual net growth.

Taking the third approach, we find that 10,800 owners in Vermont say that they intend to harvest some time within the coming 10 years. This means that about 1,080 potential timber sellers will be in the market annually. Using the same set of assumptions used in New Hampshire, we estimate that 108,000 acres will be available for harvesting in Vermont, containing a total available volume of 75.6 million cubic feet.

In 1972, 40.0 million cubic feet of growing stock was removed from Vermont's privately owned commercial forest land *(Kingsley 1977)*. In that same year 96.1 million cubic feet were grown on private land in the State. Thus we find that in Vermont more timber was grown than was harvested and, since theoretically 75.6 million cubic feet was available, it would appear that more was offered for harvesting than was demanded.

Interpreting the Estimates

Of these three different estimates of available timber in each state, which is most nearly correct depends largely upon what the user of these data really means when he asks "How much timber is available?" If he wants to know what portion of the total volume is held by owners who are willing to harvest timber, regardless of the size, condition, or location of the timber, or of any unrealistic restrictions the owner might place on logging, then the first estimate answers his question.

If, however, the user wishes to know, based on past performance, how much volume is held by owners who would if approached agree to harvest, he will be satisfied with the second estimate. But, if he wishes only to know how much volume will be offered for harvesting, his best estimate is the third.

There is still another way of looking at these three estimates. The third estimate would represent that volume of timber that will be offered under present conditions without any expanded effort to obtain more timber. The second estimate represents a practical ceiling. If all the growth on land held by willing harvesters could be harvested annually, this would be the limit. If, however, it were possible to realize the annual growth on all the land held by those owners who express a willingness to harvest, however vague it may be, this then is the upper limit.

Although no attempt has been made to eliminate the acreage in forest-industry ownerships, the user of these estimates should keep in mind that much, if not most, of the timber on these lands is not available on the open market. This captive timber is usually held for the exclusive use of the owner. However, in recent years many forest industries have sold stumpage, particularly when they could realize a higher return than if they held it as reserve for their own use. This is often true when a woodpulp manufacturer chooses to sell quality sawtimber as either stumpage or logs rather than to use this material as lower value pulpwood.

REASONS FOR HARVESTING OR NOT HARVESTING

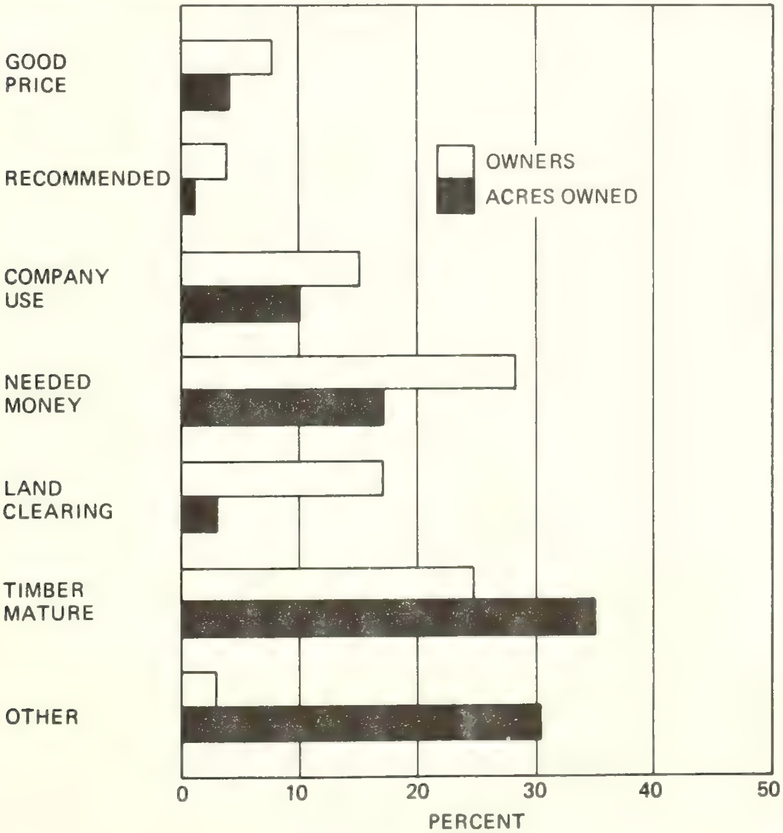
We have previously shown that the reason an owner has or has not harvested timber in the past can be a significant predictor of his future harvesting plans.

Why Owners Harvest Timber

The most prevalent reason given for harvesting timber was the need for money (fig. 8). An estimated 10,900 owners—28 percent—gave this reason. These owners control 17 percent of the commercial forest land in the two states, about 883,900 acres. Since many of these owners obviously hold relatively small tracts of timber, it would seem reasonable to conclude that few of them perceived any timber value in their forest ownership until an emergency need for money confronted them. Many apparently have the attitude that they'll let their timber grow until they need money. This attitude is apparently more prevalent in Vermont. Of the 10,900 owners who gave this reason for harvesting, an estimated 7,400 owned land in Vermont.

The second most common reason for harvesting was that the timber was mature. An estimated 9,800 owners—25 percent—gave this reason, and they hold 35 percent of the commercial forest land in the two states. These owners hold an average of 189 acres of commercial forest land. Because these owners hold somewhat larger tracts, and because they harvested their timber when it was mature, there is reason to believe that this group of forest-land owners have a more conscientious

Figure 8.—Reasons for harvesting timber in NEW HAMPSHIRE and VERMONT, by percentage of acreage and owners, 1973.



attitude toward their land. Indeed many are undoubtedly actively managing their land to one degree or another.

The third most common reason for harvesting was land-clearing. Seventeen percent—6,800 owners—harvested for this reason. These owners typically own small tracts of forest land; they account for only 3 percent of the land held by harvesters.

It is interesting to note that only 4 percent of the owners who harvested said they did so because it was recommended by a forester. These owners hold only 1 percent of the forest land held by harvesters. Also, only a very few owners reported that they harvested timber in order to improve the condition of their forest stands.

Why Owners Do Not Harvest Timber

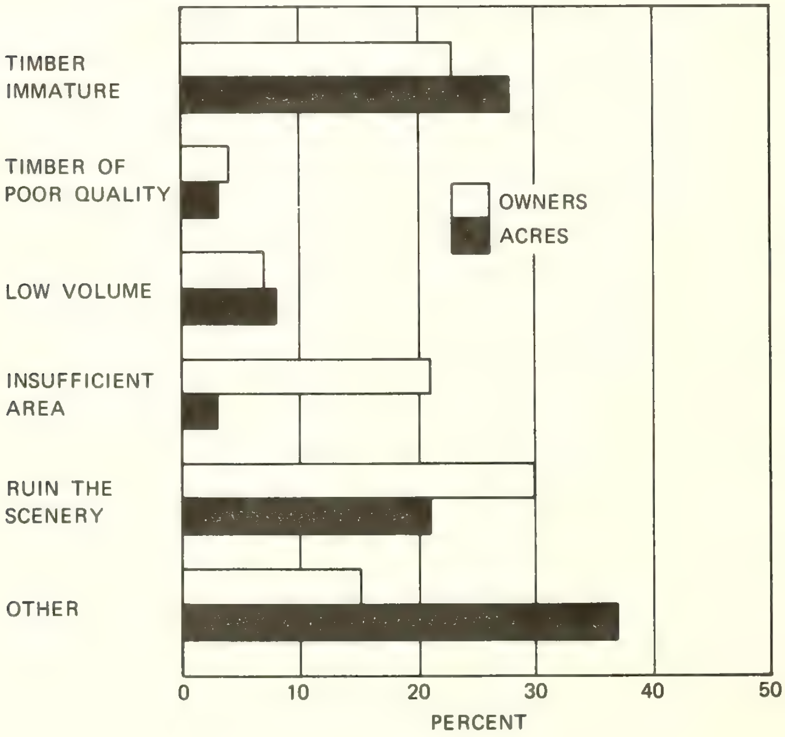
Three major groups of owners account for 74 percent of the owners who have not harvested timber. These groups are: those owners who have not harvested because their timber was immature, those owners who feel that harvesting would destroy the scenery, and those owners who feel that they have an insufficient area for timber harvesting (fig. 9).

The 28,200 owners who have not harvested because their timber is immature own 773,900 acres or 28 percent of the forest land held by nonharvesters. The average acreage owned by these owners is 27 acres; somewhat below the averages of 52 in Vermont and 47 in New Hampshire. However, most tracts, while small, would still be operable by most logging contractors *(Herrick 1975)*.

The 26,000 owners who did not harvest because they felt they did not have a sufficient area for logging appear to be justified in their reasoning. This group averaged only 3 acres per owner, or a total of 79,800. Areas this small are not likely to be of interest to timber buyers unless they are stocked with trees of unusually high value.

The 38,000 scenery-conscious owners hold an average of 15 acres—a total of 579,700. In many instances such tracts surround the owner's

Figure 9.—Reasons for NOT harvesting timber in NEW HAMPSHIRE and VERMONT, by percentage of acreage and owners, 1973.



residence or his second home; when this is the case, the possible effect of logging on scenery can be a significant deterrent to harvesting. With an average acreage owned as low as 15 acres, it is also true that many such ownerships are too small to provide realistic logging chances.

Such deterrents as low stumpage price, distrust of loggers, or a philosophical objection to harvesting were unimportant as reasons for not harvesting. Only 3 percent of the nonharvesting owners gave one of these reasons, and they control only 9 percent of the commercial forest land.

TIMBER-HARVESTING PRACTICES

Harvesting System

The definition of the various harvesting systems used in this report have been abbreviated and therefore do not agree with the more complete definitions that would be accepted by the forestry profession. Such abbreviated definitions are necessary in order to permit lay respondents to answer the question. For instance, in our questionnaire the selection system is defined as "only preselected, marked trees were removed" and clearcutting is defined as "most or all of the trees on a given area were removed". Undoubtedly many owners have reported heavy selection cuts as clearcutting. For these reasons the data presented in this section should be interpreted as indicating how the owners view the harvesting method used and not as the silvicultural system used in managing these stands.

The most commonly used method of determining which trees would be harvested is the diameter-limit method, which was chosen by 11,000 owners. With this method all harvestable trees of the species to be harvested except those smaller than a specified diameter at breast height are cut.

Although this is the most commonly used method in the two states, it is far more prevalent in Vermont. In that state 36 percent of the owners who harvested reported that this was the method used. These owners control 37 percent of the private commercial forest land held by harvesters. By comparison, diameter-limit harvesting was used by 17 percent of the New Hampshire harvesters, and they hold 31 percent of the land held by harvesters in that state.

The selection sytem of harvesting was the second most commonly used method in both states. In New Hampshire, 18 percent of the harvesting owners used this method, and in Vermont 27 percent. In New Hampshire the selection system was used on ownerships involving 32 percent of area held by harvesters and in Vermont on 33 percent.

Clearcutting was used by 14 percent of the harvesting owners in each state. However, it appears that these were generally owners of smaller than average tracts, because they account for only 5 percent of the acreage in New Hampshire and 6 percent in Vermont.

In New Hampshire 32 percent of the owners who have harvested said they did so in the process of land-clearing. These were owners of small tracts as indicated by the fact that these owners hold only 4 percent of the land held by harvesters. In Vermont, on the other hand, only 7 percent indicated land-clearing as a reason for harvesting; they hold 2 percent of the land held by harvesters. The prevalence of land-clearing in New Hampshire may be ascribed, in part, to the more forested character of that state. As of 1973 New Hampshire was 86 percent forested, and Vermont was 76 percent forested. Thus it may be that some owners in New Hampshire have cleared some of their land simply because the forest obstructed a desired view.

Who Selects the Timber to be Harvested?

Forty-nine percent of the landowners who have harvested reported that they selected the area or the timber to be harvested themselves. This does not mean that they physically marked each tree or delineated the cutting boundary. What it does mean is that they consider themselves responsible for the final decision. These owners accounted for 23 percent of the acreage held by harvesters.

Foresters selected the timber to be harvested on 35 percent of the acreage held by harvesters. This fact indicates that the larger the ownership, the more likely the owner is to use the services of forester. In fact, the acreage held by owners who used the services of a forester—1,861,200—was larger than any other.

Overwhelmingly, foresters chose the selection system. Out of the 5,500 ownerships on which a forester was responsible for selecting the timber, the selection system was chosen in 5,300 cases. In fact, of all the owners who used the selection system, foresters were responsible for the choice 58 percent of the time. The selection system was used on ownerships totaling 1.7 million acres, and foresters made the selection on 1.2 million of these.

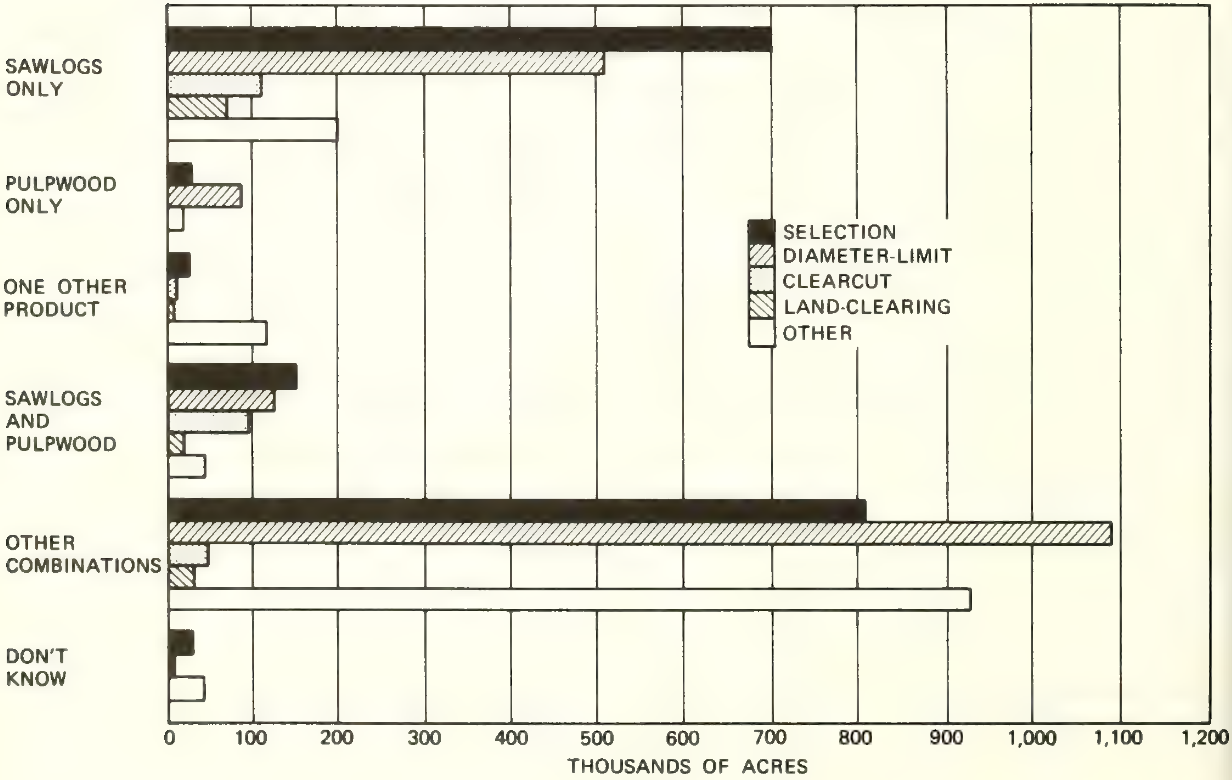
Timber buyers and landowners seem to prefer the diameter-limit system. An estimated 4,300 landowners chose this system, as did 3,700 timber buyers. When the landowner and the buyer together collaborated on the choice of timber to be harvested, 2,100 chose the diameter-limit system. Foresters, however, chose the diameter-limit method on only an estimated 200 ownerships. The popularity of the diameter-limit method with landowners and buyers is probably because it is less expensive and less difficult to administer than the selection system but does not leave an unsightly appearance as does the clearcutting system.

Clearcutting is also popular with landowners and buyers. Of the 5,300 owners who opted for this method, the decision was made by the owner himself in 3,800 cases and by the buyer in 1,300. Fewer than 50 owners who used the services of a forester chose this method of timber harvesting.

Products Harvested

More owners—17,400—harvested only sawlogs from their land than any other product or group of products (fig. 10). These owners accounted for 30 percent of the land held by harvesters—1.6 million acres. Pulpwood alone was harvested by only 4 percent holding only 2 percent of the land. The low incidence of pulpwood harvesting alone may be partially explained by the facts that there is a trend toward multiproduct harvesting in the Northeast, and except for clearcutting or land clearing, a harvest for only pulpwood in the stands of mixed size classes that are typical of both states would often imply some type of thinning.

Figure 10.—Harvesting system used and product harvested in NEW HAMPSHIRE and VERMONT, by acreage owned, 1973.



Because active intensive forest management is rare in both states, the latter is not likely.

The integrated or multiproduct harvest has become a commonplace occurrence in New Hampshire and Vermont. Thirty-five percent of the owners who have harvested reported that they harvested more than one product. These owners account for 64 percent of the land held by harvesters. The larger the ownership, the more products the owner harvests. The fewer than 50 owners who harvested 5 or more products account for 24 percent of the land held by harvesters.

FORESTRY ASSISTANCE

An estimated 18 percent of the owners of private commercial forest land have received some form of forestry assistance. However, these 18 percent control 53 percent of the acreage in the two states. The comparison of these estimates reinforces the conclusion that, the larger the area owned, the more likely the owner is to actively manage his land.

In fact, even though more owners—8,600—had assistance in timber-sales administration than in any other form of forestry assistance, the estimated 5,000 who received general forest-management assistance account for 55 percent of the acreage held by those receiving assistance—nearly 2.3 million acres. Obviously many very large industrial as well as individual owners either employ full-time foresters or have a forester available to them on a regular basis.

In Vermont more owners—an estimated 3,700—received assistance with tree planting than any other service. However, in New Hampshire tree planting ranked sixth in order of the services rendered. The already heavily forested character of New Hampshire may in part explain the difference.

The owners of small tracts of forest land often do not know where to obtain forestry services. An estimated 83,600 owners—51 percent of the total—when asked "What office, agency, or individual would you contact for forestry assistance?" replied that they didn't know. These owners, however, own an average of little more than 20 acres each. Although more owners in Vermont report that they do not know where to obtain forestry assistance, those who do not know in New Hampshire own larger tracts than those in Vermont—17 acres compared to nearly 24 acres on average.

Most New Hampshire and Vermont forest-land owners who did claim to know who to contact, said they would contact "the county" for forestry assistance. Presumably these owners mean either that they would contact the county forester or the county agent. In both states the county forester, so called, is the front line of public forestry assistance. In New Hampshire the county forestry program is administered jointly by the Department of Resources and Economic Development and the Cooperative Extension Service. In Vermont county foresters share offices, in most cases, with the Cooperative Extension Service, although they come under the direction of the Director of Forests. On average those owners who indicated that they would contact the county own 60 acres. However, the two states are not alike in this respect. The Vermont group own an average of 74 acres while those in New Hampshire average 45 acres.

Three percent of the owners said that they would contact a consulting forester. These 4,800 owners hold a little over 600,000 acres of private commercial forest land or an average of 127 acres each. In New Hampshire the owners who say they would contact a consulting forester own an average of over 160 acres each, but in Vermont they own an average of only 42 acres.

RECREATION ON PRIVATE FOREST LAND

Most owners of commercial forest land in New Hampshire and Vermont permit the general public to use their land for one form of outdoor recreation or another. Only 24 percent of the owners permit camping. These owners hold 36 percent of the privately owned commercial forest land. At the high end, 51 percent permit hunting, 51 percent permit hiking, and surprisingly, 50 percent permit snowmobiling. The owners who permit hunting hold 75 percent of the land, hiking 73 percent, and snowmobiling 59 percent.

The most likely reason so few owners permit camping is that this use usually involves some form of site degradation, littering, and fire hazard. This conclusion is strengthened by the fact that only 36 percent of the owners permit picnicking, a use that is also often associated with these same problems. On the other hand, hiking and hunting, both of which are transitory in nature, usually involve little site degradation or littering.

Although 51 percent of the owners permit some form of recreation, 69 percent do not post their land against either hunting specifically or trespassing in general. Of the 50,300 owners who do post their land, an estimated 15,200 did so in order to insure their privacy. These owners hold over one-half million acres. Another 10,200 owners posted to limit access to their land. These owners accounted for more forest land than any other group. Often when an owner indicates that he wishes to limit access to his land he desires to know who is using his land and for what purpose they are using it. In this way he is able to exclude those individuals he deems unsuitable without being forced to explain his reasons.

Only 17 percent of the owners, owning 21 percent of the private forest land, said they posted their land primarily to exclude hunters. Yet, a frequent complaint heard from hunters is that too much land is posted. In most cases, it appears, if hunters or any other recreationist presents himself to the owner he is likely to obtain permission to use the land. Conversely, just because the land is not posted does not mean that it is available for use by hunters or any other recreationists. This fact is obvious when one compares the estimate of the number of owners who do not permit use of their land by the general public—49 percent—with the estimate of those who do not post their land—69 percent.

CONCLUSIONS

The results of this study show that most forest-land owners in New Hampshire and Vermont take an active interest in their forest land and, in fact, consider it a valuable possession. Many owners are former urbanites, somewhat more affluent and somewhat older than the general population of the two states. Among individuals, the desire to hold forest land for amenity values is prevalent. This conclusion is evidenced by the fact that a large majority of the present forest-land owners in the two states indicated that they owned forest land for recreational reasons, because it was part of their residence, or that they enjoyed the open or "green space".

Despite this apparent predilection toward a nontangible interest in forest land, most New Hampshire and Vermont forest-land owners show little or no negative attitude toward timber harvesting or forest management. For this reason it would appear that opportunities for active forest management and an accompanying expansion in timber harvesting are plentiful, provided they take into account the owner's primary reasons for owning his land and those benefits he wishes to derive from the ownership of forest land. If foresters or timbers buyers expect to encourage forest management or timber harvesting in the private-noncorporate sector by appealing to the classical justifications for forestry and timber production—namely increased timber production, income, and protection of the forest complex—they will be doomed to almost certain failure. On the other hand, if they choose to gear their efforts toward enhancing those values and benefits the owner wishes to obtain from his forest land, they may meet with greater success in the long run.

Both New Hampshire and Vermont have established traditions of concern for the environment and landscape. This is evidenced by the concern in both states for adequate land-use planning and protection of the esthetic quality of the landscape. Few states are as far along toward what Aldo Leopold called a "conservation ethic". With this public attitude and the attitudes of forest-land owners specifically as expressed in this study, these states are fertile ground for active broadscale multipurpose forestry.

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APPENDIX
I
Study Method

The sampling scheme used for this study was derived from the sampling design used in the Forest Survey conducted by the Northeastern Station. Forest-Survey field crews attempted to obtain the correct name and mailing address of the owner of each of the 1,363 privately owned forested field plots in the two states (New Hampshire—748, Vermont—615). The field crews were able to obtain usable addresses for nearly 90 percent of the field plots. A total of 1,062 questionnaires were mailed to owners of commercial forest land in the two states. A total of 716 were returned with usable information (New Hampshire—367, Vermont—349).

The questionnaire used in this study was developed after investigation of several earlier ownership studies and consultations with other investigators. The questionnaire was also field-tested before the mass mailings. The mailing consisted of the questionnaire plus a cover letter explaining the purpose of the survey. Approximately 2 weeks after the first mailing, those addresses who had not responded were mailed a second copy of the questionnaire and its cover letter plus a second letter urging cooperation with the study. Approximately one month later, 596 owners had responded. Then a 100-percent field canvass of nonrespondents was attempted. This effort resulted in an additional 120 usable questionnaires (New Hampshire—66, Vermont—54).

The resulting data were compiled by electronic computer, using the FINSYS generalized computer system.[1]

Since the sampling scheme used in this study is essentially the one used in the forest survey of timber resources, it introduces a bias because the sample is proportional to the forest area being sampled and not proportional to the number of owners of forest land. To overcome this bias it was necessary to weight the numbers of owners obtained in the sample. This procedure can be stated mathematically as:

$$wx = \frac{CFLp/Nr}{Ai}$$

and Σwx_i = estimated number of private owners in the state.

where

wx = weighted number of private owners represented by the respondent.

$CFLp$ = area of privately owned commercial forest land in the state.

Nr = number of respondents in the survey.

Ai = acres owned by individual respondent.

The sum of the weighted number of owners then provides an unbiased estimate of the total number of persons who own commercial forest land in New Hampshire and Vermont.

The acreage of commercial forest land was estimated in a manner similar to that used in the forest survey. The total area of privately owned commercial forest land in each state was divided by the number of field plots represented in the ownership canvass. Thus, if a particular respondent owned land on which one forested plot was located, his response was given a weight of one. If a respondent represented two forested plots, his response received a weight of two or double the acreage, and so on. Actual reported acreage was used only to calculate the sample mean, mode, and median.

It was also necessary to determine if those questionnaires obtained through the mail and those obtained by means of the field follow-up were both samples of the same population. The hypothesis tested was that there was no significant difference in the mean acreage of the subsamples. Student's t-test showed that no significant difference existed at the 99-percent probability level.

Because this study encompassed a two-state region, it was necessary to make the calculations for each of the two states and then sum the results. The following tabulations show the pertinent data for each of the states:

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[1] Wilson, Robert W., Jr., and Robert C. Peters. The Northeastern Forest Inventory Data Processing System. I. Introduction. USDA For. Serv. Res. Pap. NE-61. 20 p., illus. 1967.

	Questionnaires mailed (No.)	Usable returned questionnaires (No.)	Plots represented by returned questionnaires (No.)	Acreage represented per plot (Acres)
New Hampshire	562	367	513	7,957
Vermont	500	349	413	9,657
Both states	1,062	716	926	--

APPENDIX
II
Sampling Errors

Sampling errors were calculated for the estimated total number of forest-land owners in each state and for the combined total. The sampling error for the number of acres of commercial forest land in private ownership was calculated as part of the forest survey. These sampling errors are presented below. The user of these data is cautioned that, as the size any estimate decreases in relation to the total estimate, the sampling error, expressed as a percentage of the estimate, increases drastically.

The inclusion of small woodland parcels (less than 10 acres) in the study population substantially influences the sampling error for the estimated number of owners. For example, the sampling error for the estimated total number of owners in New Hampshire is ±16.4 percent; eliminating the owners of tracts of less than 10 acres, it becomes ±8.5 percent. Similarly, in Vermont the sampling error is reduced from ±21.6 percent to ±7.1 percent:

For a discussion of the method of calculating these sampling errors, see: Cochran, William G. 1963. SAMPLING TECHNIQUES. 2d. ed., p. 252 (9.10 Theory for selection with arbitrary probabilities). John Wiley & Sons, Inc., New York.

	Sampling error for:	
	Acres of private Commerical forest land	*Number of owners of private commerical forest land*
New Hampshire	± 40,800 (± 1.0%)	± 14,400 (± 16.4%)
Vermont	± 119,600 (± 3.0%)	± 16,700 (± 21.6%)
Total	± 126,400 (± 1.6%)	± 22,100 (± 13.4%)

APPENDIX
III
Questionnaire

NE FOREST EXPERIMENT STATION
FOREST SERVICE, U.S. DEPARTMENT OF AGRICULTURE

OMB
Approval expires:

NORTHEASTERN WOODLAND OWNERSHIP STUDY

State ____________
County ____________
Plot ____________

Please complete the following questions to the best of your knowledge. Where actual data are not available please use your best estimate. Please be assured your answers will be held strictly confidential.

1. How much land do you now own? (Include woodlands, pasture, cropland, etc., but exclude individual house lots.) Acres ________

2. Of all of the land you own how much is woodland? Acres______ or percent____

3. Is all of the woodland you own in one state?

Yes 1. ____ What state________________
No 2. ____ My woodlands are in more than one state as follows:

__________ acres in ____________________
(state)
__________ acres in ____________________
(state)
__________ acres in ____________________
(state)
__________ acres in ____________________
(state)

4. How many individual tracts or parcels of woodland do you own? Number________

5. In what year did you first acquire woodland? Year ________

6. How did you acquire the major portion of the woodland you now own?

Purchase 1. ____
Inheritance 2. ____
Other 3. ____

7. In which one of the following ownership categories does the major portion of your woodland holdings fall? (Please check only one.)

Individual (include husband and wife) 1. ________
Joint ownership 2. ________
Undivided estate 3. ________
Partnership 4. ________
Corporation 5. ________
Club or association 6. ________
Other 7. ________

8. If the ownership is a partnership, corporation, club or association, what is the nature of the business or organization?

____

Please indicate the title of the person completing this questionnaire.

____

9. What is the approximate road mileage from your home to your nearest and furthest tract of woodland? (For businesses or organizations consider "home" to mean place of business, or location of organization.)

Miles to the nearest tract (enter zero if you live on the tract) ______
Miles to furthest tract ______

10. How many times have you or your representative visited your nearest and furthest tract of woodland in the last 12 months?

Number of visits to the nearest tract ______
Number of visits to the furthest tract ______

11. Have you ever harvested timber or trees from your land?

Yes 1. _____
No 2. _____

NOTE: IF YOU HAVE NEVER HARVESTED TIMBER OR TREES FROM YOUR WOODLAND SKIP TO QUESTION 18.

12. In what year did the most recent timber harvest take place? ________

13. What products were harvested? (Check as many as apply.)

Sawlogs 1. _____
Veneer logs or bolts 2. _____
Pulpwood 3. _____
Turnery bolts 4. _____
Posts, poles, or piling 5. _____
Mine timbers 6. _____
Christmas trees 7. _____
Other 8. _____
(please specify)________
Don't know what products were harvested 9. _____

14. How were your trees selected for harvesting? (Please check the method that accounted for the greatest volume, if more than one method was used.)

Selection (only preselected marked trees were removed) 1. _____
Diameter limit (only trees over a minimum diameter were removed) 2. _____
Please indicate minimum diameter ____________
Clearcutting (most or all of the trees on a given area were removed) 3. _____
Land clearing (trees were harvested incidental to clearing the land for a use other than woodland) 4. _____
Other (please specify) ____________________________ 5. _____
Don't know method used. 6. _____

15. Who selected the area or trees to be harvested?

Landowner 1. _____
Forester 2. _____
Friend or neighbor 3. _____
Timber buyer or logger 4. _____
Combination of ____ and ____ 5. _____

16. If you did not have the assistance of a forester in the harvesting of your timber, do you now wish you had?

Yes 1. _____
No 2. _____
No feeling either way 3. _____

17. Why did you harvest timber at the time that you did?
(Check only the one reason you consider most important.)

Felt timber was mature 1. ____
Offered a good price 2. ____
Land clearing 3. ____
Needed money 4. ____
Needed timber for own use 5. ____
Timber harvest for company use (industry only) 6. ____

18. If you have never harvested timber or trees from your land, why not?
(Please check only the reason you consider most important.)

Woodland immature - timber too small 1. ____
No market for timber 2. ____
Price offered or prevailing market price too low 3. ____
Value of land for hunting would be destroyed 4. ____
Selling or plan to sell the land 5. ____
Scenery would be destroyed 6. ____
Land tied up in estate 7. ____
Distrust of loggers 8. ____
Opposed to timber harvesting 9. ____
Poor quality timber 10. ____
No market for timber 11. ____
Not enough volume 12. ____
Logging would create a fire hazard 13. ____
Insufficient area to harvest 14. ____
Other (please specify) ______________________________ 15. ____

19. Do you plan to harvest timber from your woodlands in: (Check one)

Next 5 years 1. ____
5 to 10 years 2. ____
Possibly at some future date 3. ____
Never plan to sell timber 4. ____

20. Have you ever sought the assistance of a forester for advice or help in managing your woodland?

Yes 1. ____ Please indicate the nature of assistance ____________________

____

No 2. ____

21. What office, agency, or individual would you contact for forestry assistance? (If you don't know, please write in "don't know.")

____

22. Why do you own woodland? (Please rank in order of importance those items that are applicable, with number 1 the most important.)

Land investment (hope to sell all or part of woodland at a profit ____
Recreation (hunting, camping, fishing, etc.) ____
Timber production (growing timber or other forest products for sale) ____
Farm or domestic use (source of fence posts or other forest products for own use) ____
Part of my residence ____
Other (please specify) ______________________ ____

23. Which of the following do you feel were the most important benefits you derived from your woodland in the last 5 years? (Please rank in order of importance those items that are applicable, with number 1 the most important.)

Increase in land value (investment) ____
Recreation (hunting, fishing, camping, etc.) ____
Income from the sale of timber ____
Aesthetics (just enjoy woodland, wildlife, and the general satisfaction of owning "green space.") ____
Farm or domestic use ____
Other (please specify) ______________________ ____

24. Which of the following do you feel will be the most important benefits you expect to derive from your woodland in the next 5 years?

Increase in land value (investment) 1. ______
Recreation (hunting, fishing, camping, etc.) 2. ______
Income from sale of timber 3. ______
Aesthetics (just enjoy woodland, wildlife, and the general satisfaction of owning "green space.") 4. ______
Farm or domestic use 5. ______
Other (please specify) ____________________ 6. ______

25. Is the general public, other than your family and immediate circle of friends, permitted to use your woodland for any of the following: (Please check all appropriate items.)

Hiking 1. ______
Picnicking 2. ______
Camping 3. ______
Fishing 4. ______
Hunting 5. ______
Snowmobiling 6. ______
Other (please specify) 7. ______

____

26. My woodland is posted because: (Check the most important reason. If your land is not posted do not answer this question.)

Littering 1. ______
Damage to property or livestock 2. ______
Safety 3. ______
Protection from liability 4. ______
Control public access (I wish to know who is on my property and for what reason) 5. ______
To keep hunters out 6. ______
Privacy 7. ______
Other (please specify) ____________________ 8. ______

27. Have you been approached to sell all or part of your woodland in the last five years?

Yes 1. _____ No 2. _____

The following questions are asked to classify responses on the basis of information about the owner personally. Again, we would remind you that the answers to these questions, and to any other questions on this questionnaire, are strictly confidential. All answers will be compiled in such a manner that it will be impossible to identify any individual reply.

These questions do not pertain to and should not be answered by corporations and organizations.

If the woodland is owned by more than one person, answer the questions for one of the owners only.

28. During the first 12 years of the owner's life where did he live most of the time?

In a city with a population of 100,000 or more 1. ______
In a city with a population of 10,000 to 99,999 2. ______
In a town or city with a population of less than 10,000 3. ______
In a rural area 4. ______
On a farm 5. ______

29. What is the sex of the owner?

Male 1. _____ Female 2. _____

30. What is the age of the owner?

Under 25 1. ______
25-44 2. ______
45-64 3. ______
65 and over 4. ______

31. How many years of formal education has the owner completed?

Grades 1-8 1. ______
Grades 9-12 2. ______
Has some schooling beyond high school 3. ______
(Business or technical school, or some college.)
Has a bachelor's degree or equivalent 4. ______
Has some graduate work 5. ______
Holds a master's degree 6. ______
Holds a doctoral degree 7. ______

32. What is the primary occupation of the owner? ____________________

33. In which category would the owner's gross income fall?

Less than $3,000 1. ______
$3,000 to $9,999 2. ______
$10,000 to $14,999 3. ______
$15,000 to $29,999 4. ______
$30,000 or more per year 5. ______

34. Comments?

APPENDIX
IV
Definition of Terms

Forest land.—Land that is at least 16.7 percent stocked (contains at least 7.5 square feet of basal area) by forest trees of any size, or that formerly had such tree cover and is not currently developed for nonforest use. (Forest trees are woody plants that have a well-developed stem and usually are more than 12 feet in height at maturity.) The minimum area for classification of forest land is 1 acre.

Commercial forest land.—Forest land that is producing or capable of producing crops of industrial wood (More than 20 cubic feet per acre per year) and is not withdrawn from timber utilization. (Industrial wood: all roundwood products except fuelwood.)

Private commercial forest land.—All commercial forest land other than that owned by federal, state, or local governments or their agencies.

Softwoods.—Coniferous trees that are usually evergreen, having needles or scalelike leaves.

Hardwoods.—Dicotyledonous trees that are usually broad-leaved and deciduous.

Stand.—A growth of trees on a minimum of 1 acre of forest land that is at least 16.7 percent stocked by forest trees of any size.

Growing-stock trees.—Live trees of commercial species that are classified as sawtimber, poletimber, saplings, and seedlings; that is, all live trees of commercial species except rough and rotten trees.

Growing-stock volume.—Net volume, in cubic feet, of live growing-stock trees that are 5.0 inches dbh and over, from a 1-foot stump to a minimum 4.0-inch top diameter outside bark of the central stem.

Sawtimber trees.—Live trees of commercial species: (a) that are of the following minimum diameter at breast height: softwoods 9.0 inches and hardwoods 11.0 inches; and (b) that contain at least one 12-foot merchantable sawlog and meet regional specifications for freedom from defect.

Sawtimber volume.—Net volume in board feet, International 1/4-inch rule, of merchantable sawlogs in live sawtimber trees. Net volume equals gross volume less deductions for rot, sweep, and other defects that affect use for lumber.

Board foot.—A unit of lumber measurement 1 foot long, 1 foot wide, and 1 inch thick, or its equivalent. By forest-survey convention, softwoods less than 9.0 inches dbh and hardwoods less than 11.0 inches dbh do not contain board-foot volume.

Annual net growth.—The annual change (resulting from natural causes) in volume of sound wood in sawtimber and poletimber trees.

Timber removals.—The volume of growing stock or sawtimber trees harvested or killed in logging or in cultural operations such as timber-stand improvement, land-clearing, or changes in land use.

Forest industries.—Companies or individuals operating wood-using plants.

Timber salvage.—Removals of down, damaged, or diseased trees.

Selection system.—The method of timber harvesting in which trees of all sizes are harvested. However, in practice often only the oldest or largest trees in a stand are harvested. Trees are taken singly or in small groups, but the entire stand is never cleared off completely.

Clearcutting.—The method of timber harvesting in which the area is cut clear in the literal sense of the word; virtually all the trees, large and small, are removed. The term is often erroneously applied to any type of cutting in which all the merchantable timber is removed and all that is not merchantable is left.

Diameter limit.—The method of timber harvesting in which all trees above a specified diameter are removed.

Sawlog.—Any log from which lumber is to be sawed.

Veneer log.—Any log from which veneer is to be made either by peeling (rotary cut) or slicing.

Pulpwood.—Any log from which woodpulp is to be made. Usually measured in bolts of 4, 5, or 8 feet and somewhat smaller in diameter than either sawlogs or veneer logs.

APPENDIX
V
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Size class (acres)	Individual [a]		Corporation		Other [b]		Total	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*
				OWNERS				
1- 9	55,900	64	—	—	—	—	55,900	64
10- 19	8,200	9	—	—	—	—	8,200	9
20- 49	8,700	10	300	**	300	**	9,300	11
50- 99	6,500	7	200	**	100	**	6,800	8
100-199	4,300	5	300	**	100	**	4,700	5
200-499	1,600	2	200	**	200	**	2,000	2
500+	400	1	100	**	100	**	600	1
Total	85,600	98	1,100	1	800	1	87,500	100
				ACRES OWNED				
1- 9	159,100	4	—	—	—	—	159,100	4
10- 19	103,400	2	—	—	—	—	103,400	2
20- 49	254,600	6	8,000	**	8,000	**	270,600	7
50- 99	453,600	11	8,000	**	8,000	**	469,600	11
100-199	557,000	14	31,800	1	15,900	**	604,700	15
200-499	477,500	12	63,700	2	55,600	1	596,800	15
500+	453,600	11	1,129,900	28	294,400	7	1,877,900	46
Total	2,458,800	60	1,241,400	31	381,900	9	4,082,100	100

** Less than 0.5 percent.

[a] Includes joint ownerships.

[b] Includes partnerships, undivided estates, clubs, associations, etc.

Table 2.—Estimated number of private owners of commercial forest land and the acreage they own, by size-class and form of ownership in Vermont, 1973

Size class (acres)	Individual [a]		Corporation		Other [b]		Total	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*
				OWNERS				
1- 9	33,500	43	—	—	—	—	33,500	43
10- 19	8,600	11	—	—	1,100	1	9,700	12
20- 49	13,800	18	300	1	700	1	14,800	20
50- 99	7,700	10	—	—	100	**	7,800	10
100-199	6,200	8	200	**	400	1	6,800	9
200-499	3,500	5	100	**	300	**	3,900	5
500+	600	1	100	**	100	**	800	1
Total	73,900	96	700	1	2,700	3	77,300	100
				ACRES OWNED				
1- 9	57,900	1	—	—	—	—	57,900	1
10- 19	96,500	2	—	—	9,700	**	106,200	3
20- 49	357,200	9	9,700	**	19,300	**	386,200	10
50- 99	444,200	11	—	—	9,700	**	453,900	11
100-199	695,300	18	19,300	**	57,900	1	772,500	19
200-499	859,400	22	38,600	1	48,300	1	946,300	24
500+	425,100	11	791,900	20	48,300	1	1,265,300	32
Total	2,935,600	74	859,500	22	193,200	4	3,988,300	100

**Less than 0.5 percent.

[a] Includes joint ownerships.

[b] Includes partnerships, undivided estates, clubs, associations, etc.

Table 3.—Estimated number of private owners of commercial forest land and the acreage they own, by ownership category and state, New Hampshire and Vermont, 1973

Ownership category	New Hampshire		Vermont		Total	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*
			OWNERS			
Non-corporate [a]	86,100	98	76,100	98	162,200	98
Forest industry	*	**	100	**	100	**
Non-forest industry	300	**	*	**	300	**
Non-industrial business	100	**	100	**	200	**
Corporate farms	*	**	*	**	*	**
Development real estate	600	1	500	1	1,100	1
Other [b]	400	1	500	1	900	1
Total	87,500	100	77,300	100	164,800	100
			ACRES OWNED			
Non-corporate [a]	2,832,800	70	3,080,600	77	5,903,700	73
Forest industry	946,900	23	666,300	17	1,613,200	20
Non-forest industry	55,700	1	48,300	1	104,000	1
Non-industrial business	15,900	1	9,600	**	25,500	**
Corporate farms	8,000	**	19,300	1	27,300	1
Development real estate	127,300	3	115,800	3	252,800	3
Other [b]	95,500	2	48,400	1	143,900	2
Total	4,082,100	100	3,988,300	100	8,070,400	100

* Fewer than 50 owners.

** Less than 0.5 percent.

[a] Includes individuals, joint ownerships, and partnerships.

[b] Includes clubs, youth organizations, churches, and educational institutions.

Table 4.—Estimated number of individual owners of commercial forest land and the acreage they own, by occupation and state, New Hampshire and Vermont, 1973

Occupation	New Hampshire		Vermont		Total	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*
			OWNERS			
Professional	14,900	18	8,500	12	23,400	15
Executive	5,300	6	17,300	23	22,600	14
Retired	13,800	16	9,000	12	22,800	14
White collar	22,400	26	4,300	6	26,700	17
Skilled laborer	23,300	27	21,100	28	44,400	28
Unskilled laborer	1,700	2	1,900	3	3,600	2
Housewife	2,000	3	3,700	5	5,700	4
Farmer	1,100	1	7,600	10	8,700	5
Other	1,100	1	500	1	1,600	1
Total	85,600	100	73,900	100	159,500	100
			ACRES OWNED			
Professional	519,000	21	648,800	22	1,167,800	22
Executive	465,400	19	465,000	16	930,400	17
Retired	508,500	21	605,600	21	1,114,100	21
White collar	289,800	12	259,500	9	549,300	10
Skilled laborer	306,600	12	151,400	5	458,000	8
Unskilled laborer	79,800	3	64,900	2	144,700	3
Housewife	96,600	4	97,300	3	193,900	4
Farmer	175,600	7	589,000	20	764,600	14
Other	17,500	1	54,100	2	71,600	1
Total	2,458,800	100	2,935,600	100	5,394,400	100

Table 5.—Age class of individual owners, by number of owners and acreage of commercial forest land owned, New Hampshire and Vermont, 1973

Age class (years)	Owners		Commercial forest land owned	
	Number	*Percent*	*Acres*	*Percent*
	OWNERS WHO HARVESTED			
Under 45	4,500	13	503,700	17
45-64	17,100	49	1,553,600	54
65 plus	13,300	38	845,800	29
Total	34,900	100	2,903,100	100
	OWNERS WHO HAVE NOT HARVESTED			
Under 45	78,100	63	832,100	33
45-64	30,600	24	1,245,400	50
65 plus	15,900	13	413,800	17
Total	124,600	100	2,491,300	100
	ALL OWNERS			
Under 45	82,600	52	1,335,800	25
45-64	47,700	30	2,799,000	52
65 plus	29,200	18	1,259,600	23
Total	159,500	100	5,394,400	100

Table 6.—Years of completed formal education for individual owners, by number of owners and acres of commercial forest land owned, New Hampshire and Vermont, 1973

Education level	Owners		Commercial forest land owned	
	Number	*Percent*	*Acres*	*Percent*
0-8 years	17,200	11	666,200	12
9-12 years	46,400	29	1,353,700	25
Beyond high school	60,600	38	1,021,600	19
Bachelor's degree	12,900	8	950,800	18
Graduate school	3,200	2	354,400	7
Master's degree	11,300	7	613,200	11
Doctor's degree	7,900	5	434,500	8
Total	159,500	100	5,394,400	100

Table 7.—Individual owners by income groups, number of owners, and acres of commercial forest land owned, New Hampshire and Vermont, 1973

Annual income	Owners		Commercial forest land owned	
	Number	*Percent*	*Acres*	*Percent*
OWNERS WHO HARVESTED				
Under $3,000	3,400	10	313,000	11
$ 3,000 - 10,000	14,600	42	615,600	21
$10,000 - 15,000	8,000	23	520,800	18
$15,000 - 30,000	4,600	13	622,100	21
$30,000 plus	4,300	12	831,600	29
Total	34,900	100	2,903,100	100
OWNERS WHO HAVE NOT HARVESTED				
Under $3,000	9,700	8	176,100	7
$ 3,000 - 10,000	44,300	35	416,400	17
$10,000 - 15,000	26,400	21	562,200	22
$15,000 - 30,000	29,300	24	573,500	23
$30,000 plus	14,900	12	763,100	31
Total	124,600	100	2,491,300	100
ALL OWNERS				
Under $3,000	13,100	8	489,100	9
$ 3,000 - 10,000	58,900	37	1,032,000	19
$10,000 - 15,000	34,400	22	1,083,000	20
$15,000 - 30,000	33,900	21	1,195,600	22
$30,000 plus	19,200	12	1,594,700	30
Total	159,500	100	5,394,400	100

Table 8.—Early life environment of individual owners, by number of owners and acreage of commercial forest land owned, New Hampshire and Vermont, 1973

Type of environment [a]	Owners		Commercial forest land owned	
	Number	*Percent*	*Acres*	*Percent*
	OWNERS WHO HARVESTED			
City over 15,000	8,000	24	798,700	28
Town under 15,000	8,300	24	443,900	15
Rural area	18,600	52	1,660,500	57
Total	34,900	100	2,903,100	100
	OWNERS WHO HAVE NOT HARVESTED			
City over 15,000	46,000	37	1,079,700	43
Town under 15,000	35,700	29	496,800	20
Rural area	42,900	34	914,800	37
Total	124,600	100	2,491,300	100
	ALL OWNERS			
City over 15,000	54,000	34	1,878,400	35
Town under 15,000	44,000	28	940,700	17
Rural area	61,500	38	2,575,300	48
Total	159,500	100	5,394,400	100

[a] First 12 years of life.

Table 9.—Period of ownership of commercial forest land, by number of owners and acres owned, New Hampshire and Vermont, 1973

Period of ownership (years)	Owners		Commercial forest land owned	
	Number	*Percent*	*Acres*	*Percent*
	OWNERS WHO HARVESTED			
Less than 5	3,000	8	365,800	7
5- 9	5,700	14	464,000	9
10-24	16,300	42	1,439,100	27
25-49	11,300	29	1,986,000	38
More than 50	2,800	7	1,031,300	19
Total	39,100	100	5,286,200	100
	OWNERS WHO HAVE NOT HARVESTED			
Less than 5	58,500	46	691,700	25
5- 9	20,800	17	650,800	23
10-24	33,900	27	1,008,700	36
25-49	11,400	9	330,300	12
More than 50	1,100	1	102,700	4
Total	125,700	100	2,784,200	100
	ALL OWNERS			
Less than 5	61,500	37	1,057,500	13
5- 9	26,500	16	1,114,800	14
10-24	50,200	31	2,447,800	30
25-49	22,700	14	2,316,300	29
More than 50	3,900	2	1,134,000	14
Total	164,800	100	8,070,400	100

Table 10.—Distance owner's residence is from his nearest tract, by number of owners and acreage of commercial forest land owned, New Hampshire and Vermont, 1973

Distance from tract	Owners		Commercial forest land owned	
	Number	*Percent*	*Acres*	*Percent*
Residence to 5 miles	136,400	83	6,398,000	79
6- 15 miles	6,900	4	480,100	6
16- 25 miles	800	1	95,200	1
26- 50 miles	1,900	1	136,400	2
51-100 miles	6,500	4	201,900	3
100 miles plus	12,300	7	758,800	9
Total	164,800	100	8,070,400	100

Table 11.—Number of tracts of commercial forest land owned, by number of owners and total acreage they own, New Hampshire and Vermont, 1973

Number of tracts	Owners		Commercial forest land owned	
	Number	*Percent*	*Acres*	*Percent*
OWNERS WHO HARVESTED				
1	26,800	69	2,084,900	39
2	6,000	15	599,400	11
3	2,300	6	347,700	8
4	1,600	4	276,100	5
5	1,400	3	176,000	3
6 plus	1,000	3	1,802,100	34
Total	39,100	100	5,286,200	100
OWNERS WHO HAVE NOT HARVESTED				
1	114,100	91	1,704,400	61
2	8,800	7	563,100	20
3	1,400	1	192,300	7
4	600	1	72,100	3
5	200	**	33,600	1
6 plus	600	**	218,700	8
Total	125,700	100	2,784,200	100
ALL OWNERS				
1	140,900	85	3,789,300	47
2	14,800	10	1,162,500	14
3	3,700	2	540,000	7
4	2,200	1	348,200	4
5	1,600	1	209,600	3
6 plus	1,600	1	2,020,800	25
Total	164,800	100	8,070,400	100

**Less than 0.5 percent.

Table 12.—Reason for owning commercial forest, by number of owners, acres owned, and by state, New Hampshire and Vermont, 1973 [a]

Reason	New Hampshire		Vermont		Total	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*
			OWNERS			
Land investment	5,900	7	10,000	13	15,900	10
Recreation	16,700	20	17,900	23	34,600	21
Timber production	3,800	4	5,400	7	9,200	6
General farm use	7,200	8	6,600	9	13,800	8
Place of residence	48,300	55	25,900	33	74,200	45
Other	5,600	6	11,500	15	17,100	10
Total	87,500	100	77,300	100	164,800	100
			ACRES OWNED			
Land investment	778,200	19	548,600	14	1,326,800	17
Recreation	880,500	22	873,900	22	1,754,400	22
Timber production	933,900	23	760,700	19	1,694,600	21
General farm use	278,200	7	479,900	12	758,100	9
Place of residence	719,500	17	824,400	21	1,543,900	19
Other	491,800	12	500,800	12	992,600	12
Total	4,082,100	100	3,988,300	100	8,070,400	100

[a] Based on a pooling of the first four reasons given.

Table 13.—Reason for owning commercial forest land, by number of owners who have harvested timber and by the number of acres they own, by state, New Hampshire and Vermont, 1973 [a]

Reason	New Hampshire		Vermont		Total	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*
			OWNERS			
Land investment	2,500	3	2,400	3	4,900	3
Recreation	2,400	3	3,200	4	5,600	3
Timber production	1,900	2	4,300	6	6,200	4
General farm use	1,900	2	3,800	5	5,700	3
Place of residence	7,000	8	6,900	9	13,900	9
Other	400	**	2,400	3	2,800	2
Total	16,100	18	23,000	30	39,100	24
			ACRES OWNED			
Land investment	507,300	12	336,700	9	844,000	11
Recreation	540,700	14	480,400	12	1,021,100	13
Timber production	787,700	19	644,700	16	1,432,400	18
General farm use	153,500	4	328,500	8	482,000	6
Place of residence	293,700	7	476,300	12	770,000	9
Other	367,100	9	369,600	9	736,700	9
Total	2,650,000	65	2,636,200	66	5,286,200	66

** Less than 0.5 percent.

[a] See footnote, table 12.

Table 14.—Reason for owning commercial forest land, by number of owners who have not harvested timber and by the number of acres they own, by state, New Hampshire and Vermont, 1973[a]

Reason	New Hampshire		Vermont		Total	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*
			OWNERS			
Land investment	3,400	4	7,600	10	11,000	7
Recreation	14,300	17	14,700	19	29,000	18
Timber production	1,900	2	1,100	1	3,000	2
General farm use	5,300	6	2,800	3	8,100	5
Place of residence	41,300	47	19,000	25	60,300	36
Other	5,200	6	9,100	12	14,300	8
Total	71,400	82	54,300	70	125,700	76
			ACRES OWNED			
Land investment	270,900	7	211,900	5	482,800	6
Recreation	339,800	8	393,500	10	733,300	9
Timber production	146,200	4	116,000	3	262,200	3
General farm use	124,700	3	151,400	4	276,100	3
Place of residence	425,800	10	348,100	9	773,900	10
Other	124,700	3	131,200	3	255,900	3
Total	1,432,100	35	1,352,100	34	2,784,200	34

[a] See footnote, table 12.

Table 15.—Benefits derived from the ownership of commercial forest land in the last 5 years and benefits expected in the next 5 years, by numbers of owners who have and number who have not harvested timber and by the number of acres they own, New Hampshire and Vermont, 1973

Benefits	Last 5 years				Next 5 years			
	Owners		Commercial forest land owned		Owners		Commercial forest land owned	
	Number	*Percent*	*Acres*	*Percent*	*Number*	*Percent*	*Acres*	*Percent*
OWNERS WHO HARVESTED								
Recreation	5,300	3	979,300	12	1,000	1	270,500	3
Sale of timber	5,300	3	1,216,100	15	2,200	1	710,300	9
Land value increase	10,600	7	1,103,800	14	12,900	8	1,241,500	16
Esthetics	11,500	7	923,000	11	14,700	9	996,700	12
Farm and domestic use	5,300	3	468,800	6	6,800	4	547,200	7
Other	1,100	1	595,200	8	1,500	1	1,520,000	19
Total	39,100	24	5,286,200	66	39,100	24	5,286,200	66
OWNERS WHO HAVE NOT HARVESTED								
Recreation	26,200	16	704,700	9	15,900	9	337,800	4
Sale of timber	—	—	—	—	800	1	92,900	1
Land value increase	23,000	14	624,300	8	29,400	18	685,800	8
Esthetics	47,800	29	1,038,500	13	68,700	41	1,337,800	17
Farm and domestic use	16,400	10	300,800	3	7,500	5	225,200	3
Other	12,300	7	115,900	1	3,400	2	104,700	1
Total	125,700	76	2,784,200	34	125,700	76	2,784,200	34
ALL OWNERS								
Recreation	31,500	19	1,684,000	21	16,900	10	608,300	7
Sale of timber	5,300	3	1,216,100	15	3,000	2	803,200	10
Land value increase	33,600	21	1,728,100	22	42,300	26	1,927,300	24
Esthetics	59,300	36	1,961,500	24	83,400	50	2,334,500	29
Farm and domestic use	21,700	13	769,600	9	14,300	9	772,400	10
Other	13,400	8	711,100	9	4,900	3	1,624,700	20
Total	164,800	100	8,070,400	100	164,800	100	8,070,400	100

Table 16.—Reason for harvesting timber, by ownership groups, number of owners, and acres owned, New Hampshire and Vermont, 1973

Reason	Individuals [a]		Corporations		Other [b]		Total	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*
				OWNERS				
Timber mature	7,600	19	400	1	1,800	5	9,800	25
Land clearing	6,200	16	500	1	100	**	6,800	17
Need of money	10,300	26	400	1	200	1	10,900	28
Company use	5,700	15	100	**	100	**	5,900	15
Recommended	1,500	4	*	**	—	—	1,500	4
Good price	2,800	8	*	**	100	**	2,900	8
Other [c]	800	2	*	**	500	1	1,300	3
Total	34,900	90	1,400	3	2,800	7	39,100	100
				ACRES OWNED				
Timber mature	1,230,600	23	290,900	6	328,200	6	1,849,700	35
Land clearing	127,500	2	23,900	1	17,700	**	169,100	3
Need of money	740,700	14	114,200	2	29,000	1	883,900	17
Company use	411,900	8	72,100	1	39,700	1	523,700	10
Recommended	52,800	1	15,900	**	—	—	68,700	1
Good price	211,500	4	8,000	**	19,300	**	238,800	4
Other [c]	128,100	3	1,396,900	26	27,300	1	1,552,300	30
Total	2,903,100	55	1,921,900	36	461,200	9	5,286,200	100

* Fewer than 50 owners.

** Less than 0.5 percent.

[a] Includes joint ownerships.

[b] Includes partnerships, undivided estates, clubs, associations, etc.

[c] Includes salvage and cultural operations.

Table 17.—Reason for not harvesting, by ownership group, number of owners, and acres owned, New Hampshire and Vermont, 1973

Reason	Individuals [a]		Corporations		Other [b]		Total	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*
				OWNERS				
Timber immature	28,100	22	*	**	100	**	28,200	23
Timber of poor quality	5,600	4	—	—	—	—	5,600	4
Low volume	9,200	7	100	**	—	—	9,300	7
Insufficient area	26,000	21	—	—	—	—	26,000	21
Low price	1,200	1	100	**	—	—	1,300	1
Would ruin scenery	37,800	30	100	**	100	**	38,000	30
Opposed to harvesting	600	1	—	—	—	—	600	1
Would destroy hunting	1,400	1	—	—	—	—	1,400	1
Planning to sell	700	1	**	**	100	**	800	1
Distrust loggers	1,500	1	—	—	—	—	1,500	1
Other	12,500	10	100	**	400	**	13,000	10
Total	124,600	99	400	**	700	1	125,700	100
				ACRES OWNED				
Timber immature	719,300	26	27,300	1	27,300	1	773,900	28
Timber of poor quality	93,100	3	—	—	—	—	93,100	3
Low volume	190,400	7	24,000	1	—	—	214,400	8
Insufficient area	79,800	3	—	—	—	—	79,800	3
Low price	78,500	3	8,000	**	—	—	86,500	3
Would ruin scenery	536,500	19	25,600	1	17,600	1	579,700	21
Opposed to harvesting	74,700	3	—	—	—	—	74,700	3
Would destroy hunting	83,000	3	—	—	—	—	83,000	3
Planning to sell	63,600	2	49,400	2	31,800	1	144,800	5
Distrust loggers	84,800	3	—	—	—	—	84,800	3
Other	487,600	18	44,700	1	37,200	1	569,500	20
Total	2,491,300	90	179,000	6	113,900	4	2,784,200	100

* Fewer than 50 owners.

** Less than 0.5 percent.

[a] Includes joint ownerships.

[b] Includes partnerships, undivided estates, clubs, associations, etc.

Table 18.—Forest products harvested, by number of owners and acres owned, by state, New Hampshire and Vermont, 1973

Product harvested	New Hampshire		Vermont		Total	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*
			OWNERS			
Sawlogs only	10,900	68	6,500	28	17,400	44
Pulpwood only	600	4	1,000	4	1,600	4
One other product	1,300	8	3,200	14	4,500	12
Sawlogs and pulpwood	1,400	8	2,900	13	4,300	11
Other two-product combination	800	5	5,800	25	6,600	17
Three products	600	4	1,800	8	2,400	6
Four products	200	1	100	1	300	1
Five or more products	*	**	*	**	*	**
Don't know	300	2	1,700	7	2,000	5
Total	16,100	100	23,000	100	39,100	100
			ACRES OWNED			
Sawlogs only	827,100	31	747,600	29	1,574,700	30
Pulpwood only	88,300	3	39,300	1	127,600	2
One other product	56,200	2	98,400	4	154,600	3
Sawlogs and pulpwood	104,400	4	324,600	12	429,000	8
Other two-product combination	200,800	8	550,800	21	751,600	14
Three products	385,400	15	245,900	9	631,300	12
Four products	224,800	8	68,900	3	293,700	6
Five or more products	722,800	27	521,400	20	1,244,200	24
Don't know	40,200	2	39,300	1	79,500	1
Total	2,650,000	100	2,636,200	100	5,286,200	100

* Fewer than 50 owners.

** Less than 0.5 percent.

Table 19.—Method of selecting timber to be harvested, by individual who selected the timber, by number of owners, and acres owned, New Hampshire and Vermont, 1973

Who selected	Selection	Diameter limit	Clearcut	Land clearing	Other [a]	Don't know	Total	Percent
				OWNERS				
Landowner	1,800	4,300	3,800	6,500	2,100	500	19,000	49
Forester	5,300	200	*	—	*	—	5,500	14
Buyer	500	3,700	1,300	100	1,700	1,900	9,200	24
Landowner and forester	500	300	100	—	300	—	1,200	3
Landowner and buyer	700	2,100	100	200	100	100	3,300	8
Other	300	400	—	—	200	—	900	2
Total	9,100	11,000	5,300	6,800	4,400	2,500	39,100	100
				ACRES OWNED				
Landowner	237,200	462,400	113,800	117,400	233,100	55,800	1,219,700	23
Forester	1,174,000	544,000	39,900	—	103,300	—	1,861,200	35
Buyer	79,700	299,300	75,800	8,000	107,600	53,900	624,300	12
Landowner and forester	109,700	86,500	10,000	—	39,800	—	246,000	5
Landowner and buyer	59,900	236,700	38,000	10,000	15,900	9,900	370,400	7
Other	61,800	179,300	—	—	723,500	—	964,600	18
Total	1,722,300	1,808,200	277,500	135,400	1,223,200	119,600	5,286,200	100

* Fewer than 50 owners.

[a] Combination of methods.

Table 20.—Method of selecting timber to be harvested, by product harvested, number of owners, and acres owned, New Hampshire and Vermont, 1973

Products harvested	Selection	Diameter limit	Clearcut	Land clearing	Other [a]	Don't know	Total	Percent
				OWNERS				
Sawlogs only	4,000	5,000	1,500	4,500	2,100	300	17,400	44
Pulpwood	900	600	—	—	100	—	1,600	4
One other product	200	—	2,400	400	1,200	300	4,500	12
Sawlogs and pulpwood	800	2,000	1,200	200	100	—	4,300	11
Other two-product combination	2,000	1,900	100	1,500	600	500	6,600	17
Three or more products	600	1,500	*	200	200	200	2,700	7
Don't know	600	—	100	—	100	1,200	2,000	5
Total	9,100	11,000	5,300	6,800	4,400	2,500	39,100	100
				ACRES OWNED				
Sawlogs only	698,900	501,800	109,900	69,500	167,000	27,600	1,574,700	30
Pulpwood only	25,700	85,200	—	—	16,700	—	127,600	2
One other product	24,000	—	9,800	8,100	85,400	27,300	154,600	3
Sawlogs and pulpwood	145,000	130,300	92,000	17,900	43,800	—	429,000	8
Other two-product combination	294,000	272,700	9,800	31,800	124,000	19,300	751,600	14
Three or more products	506,900	818,200	47,900	8,100	778,300	9,800	2,169,200	41
Don't know	27,800	—	8,100	—	8,000	35,600	79,500	2
Total	1,722,300	1,808,200	277,500	135,400	1,223,200	119,600	5,286,200	100

* Fewer than 50 owners.

[a] Combination of methods

Table 21.—Expected time of future timber harvest, by number of owners and acres owned, by state, New Hampshire and Vermont, 1973

Expected time of future harvest	New Hampshire		Vermont		Total	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*
			OWNERS			
0- 5 years	4,900	6	6,500	8	11,400	7
6-10 years	1,300	1	4,300	6	5,600	3
Indefinite	22,400	26	24,000	31	46,400	28
Never intends to cut	58,900	67	42,500	55	101,400	62
Total	87,500	100	77,300	100	164,800	100
			ACRES OWNED			
0- 5 years	1,963,300	48	1,693,500	43	3,656,800	45
6-10 years	261,800	7	330,700	8	592,500	8
Indefinite	1,276,200	31	1,493,100	37	2,769,300	34
Never intends to cut	580,800	14	471,000	12	1,051,800	13
Total	4,082,100	100	3,988,300	100	8,070,400	100

Table 22.—Agency that owners would contact for forestry assistance, by number of owners and acres owned, by state, New Hampshire and Vermont, 1973

Agency	New Hampshire		Vermont		Total	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*
			OWNERS			
County	22,300	25	24,800	32	47,100	29
State	2,600	3	1,900	3	4,500	3
Soil Conservation Service	2,100	3	300	**	2,400	1
Forest Service	1,600	2	3,100	4	4,700	3
Consulting and industrial forester	3,500	4	1,400	2	4,900	3
Cooperative Extension Service	16,000	18	1,200	2	17,200	10
Other	100	**	300	**	400	**
Don't know	39,300	45	44,300	57	83,600	51
Total	87,500	100	77,300	100	164,800	100
			ACRES OWNED			
County	1,000,900	24	1,835,800	46	2,836,700	35
State	235,500	6	426,200	11	661,700	8
Soil Conservation Service	98,100	2	43,700	1	141,800	2
Forest Service	137,400	3	76,500	2	213,900	3
Consulting and industrial forester	1,501,400	37	721,200	18	2,222,600	28
Cooperative Extension Service	157,000	4	120,200	3	277,200	3
Other	19,600	1	10,700	**	30,300	**
Don't know	932,200	23	754,000	19	1,686,200	21
Total	4,082,100	100	3,988,300	100	8,070,400	100

** Less than 0.5 percent.

Table 23.—Owners who have received forestry assistance, by nature of assistance, number of owners, and acres owned, by state, New Hampshire and Vermont, 1973

Nature of service received	New Hampshire		Vermont		Total	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*
			OWNERS			
Timber-marking	2,300	3	3,500	5	5,800	4
Timber-stand improvement	3,200	4	2,300	2	5,500	3
Tree-planting	700	1	3,700	5	4,400	3
Timber-sales administration	8,300	9	300	**	8,600	5
Insect and disease control	400	**	600	1	1,000	1
Timber-stand evaluation	1,500	2	800	1	2,300	1
Surveying	200	**	100	**	300	**
General forest management	2,000	2	3,000	4	5,000	3
Other	300	**	800	1	1,100	1
Total [a]	16,500	19	13,800	18	30,300	18
			ACRES OWNED			
Timber-marking	374,000	9	550,500	14	924,500	11
Timber-stand improvement	485,400	12	270,400	7	755,800	9
Tree-planting	87,500	2	202,800	5	290,300	4
Timber-sales administration	87,500	2	48,300	1	135,800	2
Insect and disease control	31,800	1	19,300	**	51,100	1
Timber-stand evaluation	127,300	3	144,900	4	272,200	3
Surveying	47,700	1	19,300	**	67,000	1
General forest management	1,289,100	32	985,000	25	2,274,100	28
Other	47,700	1	115,900	3	163,600	2
Total [a]	2,172,400	53	2,047,300	51	4,219,700	53

** Less than 0.5 percent.

[a] Columns are not additive because many owners received more than one type of service.

Table 24.—Recreational uses permitted, by type of use, number of owners, and acres owned, by state, New Hampshire and Vermont, 1973

Use	New Hampshire		Vermont		Total	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*
			OWNERS			
Hiking	41,600	48	43,100	56	84,700	51
Picnicking	26,400	30	33,300	43	59,700	36
Camping	22,900	26	16,400	21	39,300	24
Fishing	29,500	34	31,900	41	61,400	37
Hunting	39,300	45	45,100	58	84,400	51
Snowmobiling	34,400	39	48,500	63	82,900	50
			ACRES OWNED			
Hiking	2,944,200	72	2,954,900	74	5,899,100	73
Picnicking	2,307,600	57	2,298,300	58	4,605,900	57
Camping	1,551,700	38	1,352,000	34	2,903,700	36
Fishing	2,434,900	60	2,327,200	58	4,762,100	59
Hunting	3,007,800	74	3,012,800	76	6,020,600	75
Snowmobiling	2,514,500	62	2,259,600	57	4,774,100	59

Table 25.—Reason for posting land, by number of owners and acres owned, by state, New Hampshire and Vermont, 1973

Reason	New Hampshire		Vermont		Total	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*
			OWNERS			
Littering	500	2	100	**	600	1
Damage	6,800	27	1,200	5	8,000	16
Safety	1,000	4	2,400	9	3,400	7
Liability	600	3	1,900	8	2,500	5
Access	2,800	11	7,400	29	10,200	20
Hunters	5,300	21	3,100	12	8,400	17
Privacy	6,200	25	9,000	35	15,200	30
Other	1,600	7	400	2	2,000	4
Total	24,800	100	25,500	100	50,300	100
			ACRES OWNED			
Littering	81,600	7	15,200	1	96,800	4
Damage	93,500	8	120,400	8	213,900	8
Safety	186,600	16	135,600	9	322,200	12
Liability	46,500	4	165,500	11	212,000	8
Access	163,300	14	421,600	29	584,900	23
Hunters	256,800	23	286,000	20	542,800	21
Privacy	244,900	22	256,000	18	500,900	19
Other	69,800	6	60,200	4	130,000	5
Total	1,143,000	100	1,460,500	100	2,603,500	100

**Less than 0.5 percent.

APPENDIX
VI
Metric Equivalents of Units Used in This Report

One acre = 4,068.8 square meters or 0.405 hectares.
Thousand acres = 405 hectares.
Million acres = 405,000 hectares.
One cubic foot = 28,317 cubic centimeters = 0.0283 cubic meters.
Breast height = 1.3716 meters above ground.
One foot = 30.48 centimeters or 0.3048 meters.
One inch = 25.4 millimeters or 2.54 centimeters.
One mile = 1.609 kilometers.
One square foot = 929.03 square centimeters or 0.0929 square meters.

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Headquarters of the Northeastern Forest Experiment Station are in Upper Darby, Pa. Field laboratories and research units are maintained at:

- Amherst, Massachusetts, in cooperation with the University of Massachusetts.
- Beltsville, Maryland.
- Berea, Kentucky, in cooperation with Berea College.
- Burlington, Vermont, in cooperation with the University of Vermont.
- Delaware, Ohio.
- Durham, New Hampshire, in cooperation with the University of New Hampshire.
- Hamden, Connecticut, in cooperation with Yale University.
- Kingston, Pennsylvania.
- Morgantown, West Virginia, in cooperation with West Virginia University, Morgantown.
- Orono, Maine, in cooperation with the University of Maine, Orono.
- Parsons, West Virginia.
- Pennington, New Jersey.
- Princeton, West Virginia.
- Syracuse, New York, in cooperation with the State University of New York College of Environmental Sciences and Forestry at Syracuse University, Syracuse.
- Warren, Pennsylvania.

Kingsley, Neal P., and Thomas W. Birch.
1977. **The forest-land owners of New Hampshire and Vermont.**
Northeast. For. Exp. Stn., Upper Darby, Pa.
47 p., illus. (USDA For. Serv. Resour. Bull. NE-51)

A statistical-analytical report of a mail canvass of the owners of privately owned commercial forest land in New Hampshire and Vermont, based on responses to a mail questionnaire. The study was conducted in conjunction with forest surveys of the two states. Trends in forest-land ownership and the attitudes and intentions of owners regarding reasons for owning forest land, timber management, timber harvesting, and recreational use are discussed.

KEYWORDS: forest-land owners, available timber, harvesting, forestry assistance, recreation

923:9:(742):(743)

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